5790A

AC MEASUREMENT STANDARD

Service Manual

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FLUKE ®

LIMITED WARRANTY & LIMITATION OF LIABILITY

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is one year and begins on the date of shipment. Parts, product repairs and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries or to any product which, in Fluke's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

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Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center or send the product, with a description of the difficulty, postage and insurance prepaid (FOB Destination), to the nearest Fluke authorized service center. Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that the failure was caused by misuse, alteration, accident or abnormal condition of operation or handling, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

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5/94

SERVICING SAFETY SUMMARY

This instrument has been designed and tested in accordance with IEC Publication 348, Safety Requirements for Electronic Measuring Apparatus. This manual contains information, warnings, and cautions that must be followed to ensure safe operation and to maintain the 5790A in a safe condition. Use of this equipment in a manner not specified herein may impair the protection provided by the equipment.

SAFETY TERMS IN THIS MANUAL

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to equipment.

SYMBOLS MARKED ON EQUIPMENT

DANGER — High voltage.

| Power On

Ground (earth) terminal.

Power Off

Attention — refer to the manual. This symbol indicates that information about the use of a feature is contained in the manual.

INPUT SOURCE LIMITS

To avoid electric shock or fire, connect the input terminals only to sources that do not exceed 1000V rms or dc, and that cannot exceed 200 mA operational or short-circuit current.

POWER SOURCE

The 5790A is intended to operate from a power source that will not apply more than 264V ac rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

USE THE PROPER FUSE

To avoid fire hazard, use only a fuse identical in type, voltage rating, and current rating as specified on the rear panel fuse rating label. Do not use makeshift fuses or short-circuit the fuse holder.

GROUNDING THE 5790A

The 5790A is a Safety Class I (grounded enclosure) instrument as defined in IEC 348. The enclosure is grounded through the grounding conductor of the power

cord. To avoid electrical shock, plug the power cord into a properly wired earth grounded receptacle before connecting anything to any of the binding posts, terminals, or connectors. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

USE THE PROPER POWER CORD

Use only the power cord and connector appropriate for the voltage and plug configuration in your country.

Use only a power cord that is in good condition.

Refer cord and connector changes to qualified service personnel.

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERES

To avoid explosion, do not operate the 5790A in an atmosphere of explosive gas.

DO NOT ATTEMPT TO OPERATE IF PROTECTION MAY BE IMPAIRED

If the 5790A appears damaged or operates abnormally, protection may be impaired. Do not attempt to operate it. When in doubt, have the instrument serviced.

DO NOT REMOVE COVER UNLESS QUALIFIED TO DO SO

To avoid electric shock, do not remove the 5790A cover unless you are qualified to do so. Service procedures are for qualified service personnel only.

DO NOT SERVICE ALONE

Do not perform internal service or adjustment of this product unless a person capable of rendering first aid and resuscitation is present.

USE CARE WHEN SERVICING WITH POWER ON

Dangerous voltages exist at several points inside this product. To avoid personal injury, do not touch exposed connections and components while the power is on.

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INTRODUCTION 1-1.

The 5790A makes ac-dc transfer measurements and accurate ac measurements from 700 μV to 1000V (10 Hz to 1 MHz). The optional 5790A-03 Wideband Module increases the 5790A frequency range to 30 MHz for inputs connected to the WIDEBAND 50Ω Type "N" connector. Accessory 5790A-7001 allows the use of Fluke A40 or A40A Current Shunts with 5790A for making accurate ac-dc current transfer measurements up to 20A.

Refer to the 5790A Operator Manual for operating instructions, use of the front and rear panel features, remote programming, and all other information for the operator.

This service manual is a maintenance guide for the 5790A. The following topics are included:

- Theory of operation
- Calibration
- Performance testing
- Access procedures
- Troubleshooting
- Parts lists
- Schematic diagrams

WARRANTY AND SERVICE INFORMATION 1-2.

Each 5790A is warranted for a period of 1 year on delivery to the original purchaser. The warranty is printed on the reverse side of the title page of this manual.

Factory authorized service for the 5790A is available at selected Service Centers. For warranty or after-warranty service, contact the nearest Service Center for instructions. A complete list of Service Centers appears at the end of Section 6.

To reship the 5790A, use its original shipping carton. If the original carton is not available, use a container that provides adequate protection during shipment. Protect the 5790A with at least three inches of shock-absorbing material on all sides of the container. Do not use loose fill to pad the shipping container. Loose fill allows the instrument to settle to one corner of the shipping container, which could result in damage during shipment.

SPECIFICATIONS 1-3.

Specifications are valid after allowing a warm-up period of 30 minutes, or twice the time the 5790A has been turned off, whichever is less. For example, if the 5790A has been turned off for 5 minutes, the warm-up period is 10 minutes.

To simplify evaluation of how the 5790A covers you workload, use the Absolute Uncertainty Specification. Those include stability, temperature coefficient, linearity, and traceability to external standards.

NOTE

When you use the 5790A within ±5°C of the temperature of the last calibration, you do not need to add anything to the Absolute Uncertainty Specifications to determine the ratios between 5790A uncertainties and the uncertainties of a unit under test. The initial calibration at Fluke is done at 23°C. (You can verify the temperature of the last calibration at any time by pressing the [SPEC] key.)

Use the Relative Uncertainty Specifications if you use a different procedure to calibrate the 5790A than is specified in the 5790A Service Manual. To calculate absolute uncertainty specifications under such conditions, combine the absolute uncertainty associated with your external equipment and calibration procedures with the Relative Uncertainty Specifications.

Secondary Performance and Operating Characteristics are provided for special calibration requirements such as stability or operation at temperature extremes.

Absolute Uncertainty Specifications
±5°C of Calibration Temperature

Voltage Range	Frequency Range	Absolute Uncertainty			
		AC/DC Transfer Mode ±PPM 2 Years	Measurement Mode ±(PPM of Reading + μV)		
			90 Days	1 Year	2 Years
2.2 mV	10 Hz - 20 Hz		1700 +1.3	1700 +1.3	1700 +1.3
	20 Hz - 40 Hz		740 +1.3	740 +1.3	740 +1.3
	40 Hz - 20 kHz		420 +1.3	420 +1.3	420 +1.3
	20 kHz - 50 kHz		810 +2.0	810 +2.0	820 +2.0
	50 kHz - 100 kHz		1200 +2.5	1200 +2.5	1200 +2.5
	100 kHz - 300 kHz		2300 +4.0	2300 +4.0	2300 +4.0
	300 kHz - 500 kHz		2400 +6.0	2400 +8.0	2600 +8.0
	500 kHz - 1 MHz		3200 +6.0	3500 +8.0	5000 +8.0
7 mV	10 Hz - 20 Hz		850 +1.3	850 +1.3	850 +1.3
	20 Hz - 40 Hz		370 +1.3	370 +1.3	370 +1.3
	40 Hz - 20 kHz		210 +1.3	210 +1.3	210 +1.3
	20 kHz - 50 kHz		400 +2.0	400 +2.0	410 +2.0
	50 kHz - 100 kHz		600 +2.5	600 +2.5	610 +2.5
	100 kHz - 300 kHz		1200 +4.0	1200 +4.0	1200 +4.0
	300 kHz - 500 kHz		1300 +6.0	1300 +8.0	1400 +8.0
	500 kHz - 1 MHz		2000 +6.0	2300 +8.0	3600 +8.0
22 mV	10 Hz - 20 Hz		290 +1.3	290 +1.3	290 +1.3
	20 Hz - 40 Hz		180 +1.3	190 +1.3	190 +1.3
	40 Hz - 20 kHz		110 +1.3	110 +1.3	110 +1.3
	20 kHz - 50 kHz		210 +2.0	210 +2.0	210 +2.0
	50 kHz - 100 kHz		310 +2.5	310 +2.5	310 +2.5
	100 kHz - 300 kHz		810 +4.0	810 +4.0	820 +4.0
	300 kHz - 500 kHz		860 +6.0	890 +8.0	1000 +8.0
	500 kHz - 1 MHz		1400 +6.0	1700 +8.0	2600 +8.0
70 mV	10 Hz - 20 Hz		240 +1.5	240 +1.5	240 +1.5
	20 Hz - 40 Hz		120 +1.5	120 +1.5	130 +1.5
	40 Hz - 20 kHz		64 +1.5	65 +1.5	69 +1.5
	20 kHz - 50 kHz		120 +2.0	130 +2.0	130 +2.0
	50 kHz - 100 kHz		260 +2.5	260 +2.5	260 +2.5
	100 kHz - 300 kHz		510 +4.0	510 +4.0	530 +4.0
	300 kHz - 500 kHz		660 +6.0	670 +8.0	680 +8.0
	500 kHz - 1 MHz		1100 +6.0	1100 +8.0	1300 +8.0
220 mV	10 Hz - 20 Hz	210	210 +1.5	210 +1.5	210 +1.5
	20 Hz - 40 Hz	82	84 +1.5	85 +1.5	87 +1.5
	40 Hz - 20 kHz	34	37 +1.5	38 +1.5	43 +1.5
	20 kHz - 50 kHz	67	69 +2.0	69 +2.0	73 +2.0
	50 kHz - 100 kHz		160 +2.5	160 +2.5	160 +2.5
	100 kHz - 300 kHz		240 +4.0	250 +4.0	280 +4.0
	300 kHz - 500 kHz		360 +6.0	380 +8.0	400 +8.0
	500 kHz - 1 MHz		940 +6.0	1000 +8.0	1200 +8.0
700 mV	10 Hz - 20 Hz	210	210 +1.5	210 +1.5	210 +1.5
	20 Hz - 40 Hz	73	75 +1.5	76 +1.5	78 +1.5
	40 Hz - 20 kHz	27	31 +1.5	33 +1.5	38 +1.5
	20 kHz - 50 kHz	47	50 +2.0	51 +2.0	56 +2.0
	50 kHz - 100 kHz		79 +2.5	79 +2.5	84 +2.5
	100 kHz - 300 kHz		160 +4.0	180 +4.0	210 +4.0
	300 kHz - 500 kHz		300 +6.0	300 +8.0	340 +8.0
	500 kHz - 1 MHz		900 +6.0	960 +8.0	1200 +8.0

Absolute Uncertainty Specifications
±5°C of Calibration Temperature (cont)

Voltage Range	Frequency Range	Absolute Uncertainty AC/DC Transfer Mode ±PPM 2 Years	Measurement Mode ±(PPM of Reading) 90 Days	1 Year	2 Years
2.2V	10 Hz - 20 Hz	200	200	200	200
	20 Hz - 40 Hz	63	65	66	69
	40 Hz - 20 kHz	18	22	24	29
	20 kHz - 50 kHz	43	45	46	52
	50 kHz - 100 kHz		70	71	76
	100 kHz - 300 kHz		150	160	200
	300 kHz - 500 kHz		250	260	310
	500 kHz - 1 MHz		840	900	1200
7V	10 Hz - 20 Hz	200	200	200	200
	20 Hz - 40 Hz	63	66	67	70
	40 Hz - 20 kHz	18	22	24	29
	20 kHz - 50 kHz	44	46	48	53
	50 kHz - 100 kHz		80	81	88
	100 kHz - 300 kHz		180	190	220
	300 kHz - 500 kHz		380	400	470
	500 kHz - 1 MHz		1100	1200	1500
22V	10 Hz - 20 Hz	200	200	200	200
	20 Hz - 40 Hz	63	66	67	70
	40 Hz - 20 kHz	21	25	27	31
	20 kHz - 50 kHz	44	46	48	53
	50 kHz - 100 kHz		80	81	85
	100 kHz - 300 kHz		180	190	220
	300 kHz - 500 kHz		380	400	470
	500 kHz - 1 MHz		1100	1200	1500
70V	10 Hz - 20 Hz	200	200	200	200
	20 Hz - 40 Hz	63	67	68	72
	40 Hz - 20 kHz	25	30	32	39
	20 kHz - 50 kHz	55	56	57	63
	50 kHz - 100 kHz		91	94	110
	100 kHz - 300 kHz		190	200	220
	300 kHz - 500 kHz		400	410	510
	500 kHz - 1 MHz		1100	1200	1500
220V	10 Hz - 20 Hz	200	200	200	200
	20 Hz - 40 Hz	63	67	68	72
	40 Hz - 20 kHz	23	29	31	38
	20 kHz - 50 kHz	63	67	69	77
	50 kHz - 100 kHz		96	98	110
	100 kHz - 300 kHz		210	210	260
	300 kHz - 500 kHz		440	500	700
700V	10 Hz - 20 Hz	200	200	200	200
	20 Hz - 40 Hz	92	96	99	110
	40 Hz - 20 kHz	36	39	41	47
	20 kHz - 50 kHz		120	130	150
	50 kHz - 100 kHz		400	500	850
1000V	10 Hz - 20 Hz	200	200	200	200
	20 Hz - 40 Hz	92	96	99	110
	40 Hz - 20 kHz	33	37	38	44
	20 kHz - 50 kHz		120	130	150
	50 kHz - 100 kHz		400	500	850

Relative Uncertainty Specifications
±5°C of Calibration Temperature

Voltage Range	Frequency Range	Relative Uncertainty: AC/DC Transfer Mode ±PPM 2 Years	Measurement Mode ±(PPM of Reading + μV): 90 Days	1 Year	2 Years
2.2 mV	10 Hz - 20 Hz		100 +1.3	110 +1.3	110 +1.3
	20 Hz - 40 Hz		54 +1.3	64 +1.3	68 +1.3
	40 Hz - 20 kHz		44 +1.3	57 +1.3	61 +1.3
	20 kHz - 50 kHz		57 +2.0	67 +2.0	110 +2.0
	50 kHz - 100 kHz		79 +2.5	86 +2.5	120 +2.5
	100 kHz - 300 kHz		19 +4.0	230 +4.0	390 +4.0
	300 kHz - 500 kHz		59 +6.0	720 +8.0	1200+8.0
	500 kHz - 1 MHz		22 +6.0	2600 +8.0	4400 +8.0
7 mV	10 Hz - 20 Hz		80 +1.3	83 +1.3	86 +1.3
	20 Hz - 40 Hz		33 +1.3	39 +1.3	45 +1.3
	40 Hz - 20 kHz		29 +1.3	36 +1.3	42 +1.3
	20 kHz - 50 kHz		40 +2.0	44 +2.0	63 +2.0
	50 kHz - 100 kHz		53 +2.5	57 +2.5	72 +2.5
	100 kHz - 300 kHz		11 +4.0	130 +4.0	210 +4.0
	300 kHz - 500 kHz		37 +6.0	450 +8.0	740 +8.0
	500 kHz - 1 MHz		16 +6.0	2000 +8.0	3400 +8.0
22 mV	10 Hz - 20 Hz		69 +1.3	72 +1.3	75 +1.3
	20 Hz - 40 Hz		34 +1.3	40 +1.3	46 +1.3
	40 Hz - 20 kHz		30 +1.3	36 +1.3	43 +1.3
	20 kHz - 50 kHz		40 +2.0	45 +2.0	64 +2.0
	50 kHz - 100 kHz		53 +2.5	57 +2.5	73 +2.5
	100 kHz - 300 kHz		97 +4.0	110 +4.0	160 +4.0
	300 kHz - 500 kHz		31 +6.0	380 +8.0	610 +8.0
	500 kHz - 1 MHz		12 +6.0	1500 +8.0	2500 +8.0
70 mV	10 Hz - 20 Hz		60 +1.5	61 +1.5	62 +1.5
	20 Hz - 40 Hz		27 +1.5	30 +1.5	37 +1.5
	40 Hz - 20 kHz		22 +1.5	25 +1.5	34 +1.5
	20 kHz - 50 kHz		34 +2.0	36 +2.0	44 +2.0
	50 kHz - 100 kHz		53 +2.5	54 +2.5	62 +2.5
	100 kHz - 300 kHz		11 +4.0	120 +4.0	170 +4.0
	300 kHz - 500 kHz		27 +6.0	290 +8.0	320 +8.0
	500 kHz - 1 MHz		91 +6.0	970 +8.0	1200 +8.0
220 mV	10 Hz - 20 Hz	55	60 +1.5	61 +1.5	62 +1.5
	20 Hz - 40 Hz	20	27 +1.5	29 +1.5	35 +1.5
	40 Hz - 20 kHz	17	22 +1.5	24 +1.5	31 +1.5
	20 kHz - 50 kHz	17	22 +2.0	24 +2.0	33 +2.0
	50 kHz - 100 kHz		51 +2.5	52 +2.5	59 +2.5
	100 kHz - 300 kHz		10 +4.0	120 +4.0	170 +4.0
	300 kHz - 500 kHz		26 +6.0	290 +8.0	310 +8.0
	500 kHz - 1 MHz		89 +6.0	950 +8.0	1200 +8.0
700 mV	10 Hz - 20 Hz	55	60 +1.5	61 +1.5	62 +1.5
	20 Hz - 40 Hz	20	27 +1.5	29 +1.5	34 +1.5
	40 Hz - 20 kHz	15	22 +1.5	24 +1.5	31 +1.5
	20 kHz - 50 kHz	15	22 +2.0	24 +2.0	33 +2.0
	50 kHz - 100 kHz		51 +2.5	52 +2.5	59 +2.5
	100 kHz - 300 kHz		10 +4.0	120 +4.0	170 +4.0
	300 kHz - 500 kHz		26 +6.0	270 +8.0	310 +8.0
	500 kHz - 1 MHz		89 +6.0	950 +8.0	1200 +8.0

Relative Uncertainty Specifications
±5°C of Calibration Temperature (cont)

Voltage Range	Frequency Range	Relative Uncertainty: AC/DC Transfer Mode ±PPM 2 Years	Measurement Mode ±(PPM of Reading) 90 Days	1 Year	2 Years
2.2V	10 Hz - 20 Hz	55	60	61	62
	20 Hz - 40 Hz	19	26	28	34
	40 Hz - 20 kHz	15	20	22	27
	20 kHz - 50 kHz	15	21	23	33
	50 kHz - 100 kHz		49	50	57
	100 kHz - 300 kHz		92	110	160
	300 kHz - 500 kHz		220	230	280
	500 kHz - 1 MHz		830	890	1200
7V	10 Hz - 20 Hz	55	60	61	62
	20 Hz - 40 Hz	19	27	29	36
	40 Hz - 20 kHz	15	20	22	27
	20 kHz - 50 kHz	18	23	26	35
	50 kHz - 100 kHz		62	64	73
	100 kHz - 300 kHz		140	150	180
	300 kHz - 500 kHz		360	380	450
	500 kHz - 1 MHz		1100	1200	1500
22V	10 Hz - 20 Hz	55	60	61	62
	20 Hz - 40 Hz	19	28	30	37
	40 Hz - 20 kHz	15	20	22	27
	20 kHz - 50 kHz	18	23	26	35
	50 kHz - 100 kHz		62	64	69
	100 kHz - 300 kHz		140	150	180
	300 kHz - 500 kHz		360	380	450
	500 kHz - 1 MHz		1100	1200	1500
70V	10 Hz - 20 Hz	55	60	62	63
	20 Hz - 40 Hz	19	29	31	39
	40 Hz - 20 kHz	15	23	25	34
	20 kHz - 50 kHz	22	25	27	39
	50 kHz - 100 kHz		64	68	85
	100 kHz - 300 kHz		140	150	180
	300 kHz - 500 kHz		370	390	490
	500 kHz - 1 MHz		1100	1200	1500
220V	10 Hz - 20 Hz	55	61	62	64
	20 Hz - 40 Hz	19	30	32	40
	40 Hz - 20 kHz	15	23	25	34
	20 kHz - 50 kHz	24	30	34	49
	50 kHz - 100 kHz		66	69	83
	100 kHz - 300 kHz		160	170	220
	300 kHz - 500 kHz		410	480	680
700V	10 Hz - 20 Hz	55	62	63	65
	20 Hz - 40 Hz	19	31	33	41
	40 Hz - 20 kHz	19	24	25	31
	20 kHz - 50 kHz		100	110	140
	50 kHz - 100 kHz		390	500	850
1000V	10 Hz - 20 Hz	55	62	63	65
	20 Hz - 40 Hz	19	31	33	41
	40 Hz - 20 kHz	19	24	25	31
	20 kHz - 50 kHz		100	110	140
	50 kHz - 100 kHz		390	500	850

Secondary Performance and Operating Characteristics

Voltage Range	Frequency Range	24 Hour AC Stability ±1°C Slow Filter Peak-Peak ±μV	Temperature Coefficient[1] 10°C to 40°C (PPM/°C)	Temperature Coefficient[1] 0°C to 10°C 40°C to 50°C (PPM/°C)	Input Resistance[2]
2.2 mV	10 Hz - 20 Hz	0.4	50	50	>10 MΩ
	20 Hz - 40 Hz	0.4	50	50	
	40 Hz - 20 kHz	0.4	50	50	
	20 kHz - 50 kHz	0.4	50	50	
	50 kHz - 100 kHz	0.8	75	75	
	100 kHz - 300 kHz	1.5	100	100	
	300 kHz - 500 kHz	3.0	150	150	
	500 kHz - 1 MHz	4.5	200	200	
7 mV	10 Hz - 20 Hz	0.4	15	15	>10 MΩ
	20 Hz - 40 Hz	0.4	15	15	
	40 Hz - 20 kHz	0.4	15	15	
	20 kHz - 50 kHz	0.4	15	15	
	50 kHz - 100 kHz	0.8	25	25	
	100 kHz - 300 kHz	1.5	60	60	
	300 kHz - 500 kHz	3.0	80	80	
	500 kHz - 1 MHz	4.5	125	125	
22 mV	10 Hz - 20 Hz	0.4	5	5	>10 MΩ
	20 Hz - 40 Hz	0.4	5	5	
	40 Hz - 20 kHz	0.4	5	5	
	20 kHz - 50 kHz	0.4	5	5	
	50 kHz - 100 kHz	0.8	8	8	
	100 kHz - 300 kHz	1.5	10	10	
	300 kHz - 500 kHz	3.0	40	40	
	500 kHz - 1 MHz	4.5	100	100	
		±(PPM of Reading)			
70 mV	10 Hz - 20 Hz	18	5	5	>10 MΩ
	20 Hz - 40 Hz	18	5	5	
	40 Hz - 20 kHz	18	5	5	
	20 kHz - 50 kHz	18	5	5	
	50 kHz - 100 kHz	24	8	8	
	100 kHz - 300 kHz	24	10	10	
	300 kHz - 500 kHz	48	30	30	
	500 kHz - 1 MHz	150	75	75	
220 mV	10 Hz - 20 Hz	12	1.5	3.0	>10 MΩ
	20 Hz - 40 Hz	8	1.5	3.0	
	40 Hz - 20 kHz	8	1.5	3.0	
	20 kHz - 50 kHz	8	2.0	3.0	
	50 kHz - 100 kHz	18	5.0	8.0	
	100 kHz - 300 kHz	24	10.0	10.0	
	300 kHz - 500 kHz	36	20.0	20.0	
	500 kHz - 1 MHz	120	50.0	50.0	
700 mV	10 Hz - 20 Hz	8	1.5	3.0	>10 MΩ
	20 Hz - 40 Hz	6	1.5	3.0	
	40 Hz - 20 kHz	6	1.5	3.0	
	20 kHz - 50 kHz	6	2.0	3.0	
	50 kHz - 100 kHz	12	5.0	8.0	
	100 kHz - 300 kHz	18	10.0	10.0	
	300 kHz - 500 kHz	36	20.0	20.0	
	500 kHz - 1 MHz	96	50.0	50.0	

Secondary Performance and Operating Characteristics (cont)

Voltage Range	Frequency Range	24 Hour AC Stability ±1°C Slow Filter Peak-Peak ±(PPM of Reading)	Temperature Coefficient[1] 10°C to 40°C (PPM/°C)	Temperature Coefficient[1] 0°C to 10°C, 40°C to 50°C (PPM/°C)	Input Resistance[2]
2.2V	10 Hz - 20 Hz	8	1.5	3.0	>10 MΩ
	20 Hz - 40 Hz	5	1.5	3.0	
	40 Hz - 20 kHz	5	1.5	3.0	
	20 kHz - 50 kHz	5	2.0	3.0	
	50 kHz - 100 kHz	10	5.0	8.0	
	100 kHz - 300 kHz	18	10.0	10.0	
	300 kHz - 500 kHz	30	20.0	20.0	
	500 kHz - 1 MHz	90	50.0	50.0	
7V	10 Hz - 20 Hz	8	1.5	3.0	50 kΩ
	20 Hz - 40 Hz	5	1.5	3.0	
	40 Hz - 20 kHz	5	1.5	3.0	
	20 kHz - 50 kHz	5	2.0	3.0	
	50 kHz - 100 kHz	10	5.0	8.0	
	100 kHz - 300 kHz	18	15.0	15.0	
	300 kHz - 500 kHz	30	30.0	30.0	
	500 kHz - 1 MHz	90	65.0	65.0	
22V	10 Hz - 20 Hz	8	1.5	3.0	50 kΩ
	20 Hz - 40 Hz	5	1.5	3.0	
	40 Hz - 20 kHz	5	1.5	3.0	
	20 kHz - 50 kHz	5	2.0	3.0	
	50 kHz - 100 kHz	10	5.0	8.0	
	100 kHz - 300 kHz	18	15.0	15.0	
	300 kHz - 500 kHz	30	30.0	30.0	
	500 kHz - 1 MHz	90	65.0	65.0	
70V	10 Hz - 20 Hz	8	1.5	3.0	50 kΩ
	20 Hz - 40 Hz	5	1.5	3.0	
	40 Hz - 20 kHz	5	1.5	3.0	
	20 kHz - 50 kHz	5	2.0	3.0	
	50 kHz - 100 kHz	18	5.0	8.0	
	100 kHz - 300 kHz	36	15.0	15.0	
	300 kHz - 500 kHz	48	40.0	40.0	
	500 kHz - 1 MHz	120	75.0	75.0	
220V	10 Hz - 20 Hz	8	1.5	3.0	50 kΩ
	20 Hz - 40 Hz	5	1.5	3.0	
	40 Hz - 20 kHz	5	1.5	3.0	
	20 kHz - 50 kHz	5	2.0	3.0	
	50 kHz - 100 kHz	18	5.0	8.0	
	100 kHz - 300 kHz	36	15.0	15.0	
	300 kHz - 500 kHz	48	40.0	40.0	
700V	10 Hz - 20 Hz	8	1.5	4.0	500 kΩ
	20 Hz - 40 Hz	5	1.5	4.0	
	40 Hz - 20 kHz	5	1.5	4.0	
	20 kHz - 50 kHz	18	5.0	7.0	
	50 kHz - 100 kHz	36	15.0	15.0	
1000V	10 Hz - 20 Hz	8	1.5	4.0	500 kΩ
	20 Hz - 40 Hz	5	1.5	4.0	
	40 Hz - 20 kHz	5	1.5	4.0	
	20 kHz - 50 kHz	18	5.0	7.0	
	50 kHz - 100 kHz	36	15.0	15.0	

1. Add to uncertainty when more than 5°C from calibration temperature.
2. Input capacitance approximately 100 pF.

Secondary Performance and Operating Characteristic (cont)

Voltage Range	Autorange Limits[3]		Resolution	
	Upper	Lower	Filter Fast	Filter Med/Slow
2.2 mV	2.2 mV	600μV	0.1 μV	0.1 μV
7 mV	7 mV	1.9 mV	0.1 μV	0.1 μV
22 mV	22 mV	6 mV	0.1 μV	0.1 μV
70 mV	70 mV	19 mV	0.1 μV	0.1 μV
220 mV	220 mV	60 mV	0.1 μV	0.1 μV
700 mV	700 mV	190 mV	1.0 μV	0.1 μV
2.2V	2.2V	600 mV	1.0 μV	0.1 μV
7V	7V	1.9V	10 μV	1.0 μV
22V	22V	6V	10 μV	1.0 μV
70V	70V	19V	100 μV	10 μV
220V	220V	60V	100 μV	10 μV
700V	700V	190V	1.0 mV	100 μV
1000V	1050V	600V	1.0 mV	100 μV

3. In locked ranges readings may be made approximately 1% beyond the autorange limits.

More Secondary Performance and Operating Characteristic

Maximum Non-destructive Input .... 1200V rms
Guard Isolation .... 10V peak
Volt-Hertz Product .... 1×10^8
Frequency Accuracy (from 0°C to 50°C)
  10 Hz - 120 Hz .... 100 ppm + 10 digits
  Above 120 Hz .... 100 ppm + 2 digits
Frequency Resolution .... 1.00 Hz to 119.99 Hz
0.1200 kHz to 1.1999 kHz
1.200 kHz to 11.999 kHz
12.00 kHz to 119.99 kHz
0.1200 MHz to 1.0000 MHz
1.0000 MHz to 1.1999 MHz (wideband only)
1.200 MHz to 11.999 MHz (wideband only)
12.00 to 30.00 MHz (wideband only)

Reading Rate
  <40 Hz .... 2 seconds per reading
  40 Hz .... 2 seconds decreasing linearly to 1 second at 200 Hz
  >200 Hz .... 1 second per reading

Maximum Settling Time to Full Specifications (in range lock)
  Filter Off .... 1 sample
    dc .... 6 seconds
    <200 Hz .... 8 seconds
    >200 Hz .... 4 seconds
  Filter Fast .... 4 averaged samples

More Secondary Performance and Operating Characteristic (cont)

dc .... 10 seconds
<200 Hz.............................. 16 seconds
>200 Hz.............................. 8 seconds

Filter Medium 16 averaged samples

dc .... 22 seconds
<200 Hz.............................. 32 seconds
>200 Hz.............................. 16 seconds

Filter Slow 32 averaged samples

dc .... 40 seconds
<200 Hz.............................. 64 seconds
>200 Hz.............................. 32 seconds

Filter Buffer Restart Limits:

Fine: Fast: 10 counts

Medium/Slow

<220 mV.......................... 10 counts
>220 mV.......................... 100 counts

Medium: Fast: 100 counts

Medium/Slow

<220 mV.......................... 100 counts
>220 mV.......................... 1000 counts

Course: Fast: 1000 counts

Medium/Slow

<220 mV.......................... 1000 counts
>220 mV.......................... 10000 counts

Input Waveform .... Specified for sinewave with THD less than 1%

Wideband Uncertainty Specifications (Option -03)

Voltage[4] Range	Frequency Range	Flatness[5] 1 Year ±3°C ±(% of Reading +µV)	Flatness[6] Temperature Coefficient PPM/°C	Absolute Uncertainty 0°C to 50°C[7] ±(% of Reading +µV) 90 Days	1 Year	2 Years	Resolution
2.2 mV	10 Hz - 30 Hz	0.10 +0	75	0.5 +1.2	0.6 +1.5	0.8 +2	0.1 µV
	30 Hz - 120 Hz	0.05 +0	75	0.5 +1.2	0.6 +1.5	0.8 +2	
	120 Hz - 1.2 kHz	0.05 +0	75	0.5 +1.2	0.6 +1.5	0.8 +2	
	1.2 kHz - 120 kHz	0.05 +0	75	0.5 +1.2	0.6 +1.5	0.8 +2	
	120 kHz - 500 kHz	0.07 +1	75	0.5 +1.2	0.6 +1.5	0.8 +2	
	500 kHz - 1.2 MHz	0.07 +1	75				
	1.2 MHz - 2 MHz	0.07 +1	100				
	2 MHz - 10 MHz	0.17 +1	200				
	10 MHz - 20 MHz	0.30 +1	200				
	20 MHz - 30 MHz	0.70 +2	400				
7 mV	10 Hz - 30 Hz	0.10 +0	75	0.4 +5	0.5 +7	0.7 +8	0.1 µV
	30 Hz - 120 Hz	0.05 +0	75	0.4 +5	0.5 +7	0.7 +8	
	120 Hz - 1.2 kHz	0.05 +0	75	0.4 +5	0.5 +7	0.7 +8	
	1.2 kHz - 120 kHz	0.05 +0	75	0.4 +5	0.5 +7	0.7 +8	
	120 kHz - 500 kHz	0.07 +1	75	0.4 +5	0.5 +7	0.7 +8	
	500 kHz - 1.2 MHz	0.07 +1	75				
	1.2 MHz - 2 MHz	0.07 +1	100				
	2 MHz - 10 MHz	0.10 +1	200				
	10 MHz - 20 MHz	0.17 +1	200				
	20 MHz - 30 MHz	0.37 +1	300				

Wideband Uncertainty Specifications (Option -03) (cont)

Voltage[4] Range	Frequency Range	Flatness[5] 1 Year ±3°C ±(% of Reading +μV)	Flatness[6] Temperature Coefficient PPM/°C	Absolute Uncertainty 0°C to 50°C[7] ±(% of Reading +μV)			Resolution
				90 Days	1 Year	2 Years	
		±(% of Reading)					
22 mV	10 Hz - 30 Hz	0.10	75	0.4 +10	0.5 +13	0.7 +16	
	30 Hz - 120 Hz	0.05	75	0.4 +10	0.5 +13	0.7 +16	
	120 Hz - 1.2 kHz	0.05	75	0.4 +10	0.5 +13	0.7 +16	
	1.2 kHz - 120 kHz	0.05	75	0.4 +10	0.5 +13	0.7 +16	0.1 μV
	120 kHz - 500 kHz	0.07	75	0.4 +10	0.5 +13	0.7 +16	
	500 kHz - 1.2 MHz	0.07	75				
	1.2 MHz - 2 MHz	0.07	75				
	2 MHz - 10 MHz	0.10	100				
	10 MHz - 20 MHz	0.17	100				
	20 MHz - 30 MHz	0.37	200				
70 mV	10 Hz - 30 Hz	0.10	40	0.4 +20	0.5 +30	0.6 +40	
	30 Hz - 120 Hz	0.05	40	0.4 +20	0.5 +30	0.6 +40	
	120 Hz - 1.2 kHz	0.05	40	0.4 +20	0.5 +30	0.6 +40	
	1.2 kHz - 120 kHz	0.05	40	0.4 +20	0.5 +30	0.6 +40	1.0 μV
	120 kHz - 500 kHz	0.05	40	0.4 +20	0.5 +30	0.6 +40	
	500 kHz - 1.2 MHz	0.05	40				
	1.2 MHz - 2 MHz	0.05	75				
	2 MHz - 10 MHz	0.10	100				
	10 MHz - 20 MHz	0.15	100				
	20 MHz - 30 MHz	0.35	200				
220 mV	10 Hz - 30 Hz	0.10	40	0.3 +60	0.4 +80	0.5 +100	
	30 Hz - 120 Hz	0.04	40	0.3 +60	0.4 +80	0.5 +100	
	120 Hz - 1.2 kHz	0.04	40	0.3 +60	0.4 +80	0.5 +100	
	1.2 kHz - 120 kHz	0.04	40	0.3 +60	0.4 +80	0.5 +100	1.0 μV
	120 kHz - 500 kHz	0.04	40	0.3 +60	0.4 +80	0.5 +100	
	500 kHz - 1.2 MHz	0.05	40				
	1.2 MHz - 2 MHz	0.05	75				
	2 MHz - 10 MHz	0.10	100				
	10 MHz - 20 MHz	0.15	100				
	20 MHz - 30 MHz	0.35	200				
700 mV	10 Hz - 30 Hz	0.10	40	0.3 +200	0.4 +300	0.5 +400	
	30 Hz - 120 Hz	0.03	40	0.3 +200	0.4 +300	0.5 +400	
	120 Hz - 1.2 kHz	0.03	40	0.3 +200	0.4 +300	0.5 +400	
	1.2 kHz - 120 kHz	0.03	40	0.3 +200	0.4 +300	0.5 +400	10.0 μV
	120 kHz - 500 kHz	0.03	40	0.3 +200	0.4 +300	0.5 +400	
	500 kHz - 1.2 MHz	0.05	40				
	1.2 MHz - 2 MHz	0.05	75				
	2 MHz - 10 MHz	0.10	100				
	10 MHz - 20 MHz	0.15	100				
	20 MHz - 30 MHz	0.35	200				
2.2V	10 Hz - 30 Hz	0.10	40	0.3 +300	0.35 +400	0.4 +500	
	30 Hz - 120 Hz	0.03	40	0.3 +300	0.35 +400	0.4 +500	
	120 Hz - 1.2 kHz	0.03	40	0.3 +300	0.35 +400	0.4 +500	
	1.2 kHz - 120 kHz	0.03	40	0.3 +300	0.35 +400	0.4 +500	10.0 μV
	120 kHz - 500 kHz	0.03	40	0.3 +300	0.35 +400	0.4 +500	
	500 kHz - 1.2 MHz	0.05	40				
	1.2 MHz - 2 MHz	0.05	75				
	2 MHz - 10 MHz	0.10	100				
	10 MHz - 20 MHz	0.15	100				
	20 MHz - 30 MHz	0.35	200				

Wideband Uncertainty Specifications (Option -03) (cont)

Voltage[4] Range	Frequency Range	Flatness[5] 1 Year ±3°C ±(% of Reading +µV)	Flatness[6] Temperature Coefficient PPM/°C	Absolute Uncertainty 0°C to 50°C[7] ±(% of Reading +µV)			Resolution
				90 Days	1 Year	2 Years	
7V	10 Hz - 30 Hz	0.10	40	0.3 +500	0.35 +800	0.4 +1000	100.0 µV
	30 Hz - 120 Hz	0.03	40	0.3 +500	0.35 +800	0.4 +1000	
	120 Hz - 1.2 kHz	0.03	40	0.3 +500	0.35 +800	0.4 +1000	
	1.2 kHz - 120 kHz	0.03	40	0.3 +500	0.35 +800	0.4 +1000	
	120 kHz - 500 kHz	0.03	40	0.3 +500	0.35 +800	0.4 +1000	
	500 kHz - 1.2 MHz	0.05	40				
	1.2 MHz - 2 MHz	0.05	75				
	2 MHz - 10 MHz	0.10	100				
	10 MHz - 20 MHz	0.15	100				
	20 MHz - 30 MHz	0.35	200				

4. Range limits same as INPUT1 or INPUT2.
5. Relative to 1 kHz, for 2-year specification multiply by 1.5.
6. Add to flatness specifications when more than 3°C from calibration temperature.
7. At input connector.

Wideband Characteristics

Maximum Non-Destructive Input............ 200V rms

Guard Isolation.......................... 0.5V peak

Input Impedance.........................

- 1 kHz.............................. 50Ω (±0.5%)
- 30 MHz............................. 50Ω (±5%)

Wideband VSWR with 50Ω Source

- 1 kHz.............................. 1.005
- 30 MHz............................. 1.05

Shunt Input Characteristics

- The shunt input was designed to allow ac/dc current transfers using the Fluke A40 Series current shunts.
- 5790A-7001 A40/A40A Current Shunt Adapter and Cable required.

Shunt Model Current Range

- A40................................ 2.5 mA - 5A
- A40A............................... 5A-20A

Input Resistance......................... 91Ω ±1%

Operating Input Voltage.................. 250 mV to 500 mV

Maximum Non-Destructive Input........... 50V rms

General Specifications

Warm-up Time .... 30 minutes

Relative Humidity

- Operating........................... 45% to 50°C 75% to 45°C 95% to 30°C
- Storage............................. <95% non-condensing

Altitude

- Operating........................... 3,050 meters (10,000 feet)
- Non-Operating .... 12,200 meters (40,000 feet)

Temperature

- Operating........................... 0°C to 50°C
- Calibration......................... 15°C to 35°C
- Storage............................. -40°C to 70°C

(cont)

EMI/RFI	
Complies with	FCC Part 15 Subpart B, Class B; VDE 0871, Class B; ESD: EIA PN- 1361.
Surge	ANSI C62.41-1980, Category A
Reliability	MIL-T-2880D, paragraph 3.13.3
Size	
Height	17.8 cm (7 in) standard rackmount + 1.5 cm (0.6 in)
Width	43.2 cm (17 in)
Depth	63 cm (24.8 in)
Maximum Power Requirements	
5790A	95 VA
With Wideband Option	120 VA
Weight	
5790A	24 kg (53 lb)
With Wideband	24.5 kg (54 lb)
Line Power	47 Hz to 63 Hz; ±10% of selectable line voltages: 100V, 110V, 115V, 120V, 200V, 220V, 230V, 240V
Safety	Complies with UL1244 and IEC 348-1976 and IEC 1010 and CSA C22.2 No. 231 and ANSI/ISA S82
Remote Interfaces	RS-232, IEEE-488

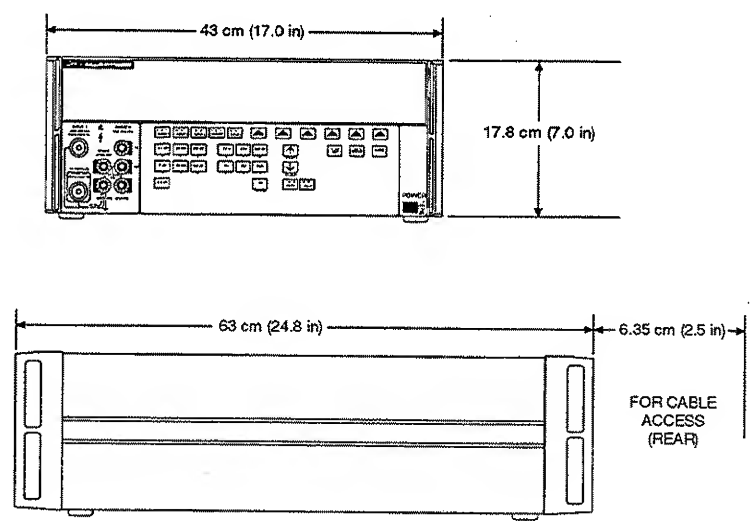

Figure 1-1. Dimensions

Section 2
Theory of Operation

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INTRODUCTION 2-1.

This section provides theory of operation in increasing level of detail. The 5790A is first defined in terms of how it makes internal ac-dc transfers to measure unknown ac voltages. Detailed circuit descriptions follow, first for system interconnections including the motherboards, then for digital assemblies, and finally for the analog assemblies. The section ends with a discussion of how the 5790A uses calibration constants.

Most of this section is devoted to detailed circuit descriptions, first in the digital (unguarded) section, then in the analog (guarded) section.

5790A OVERVIEW 2-2.

The 5790A AC Measurement Standard is configured internally as an automated ac-dc transfer standard. All measurements are controlled by internal microprocessors. The following elements are among those critical to establishing the accuracy of the 5790A.

- The FTS (Fluke RMS Thermal Sensor) is the transfer element. It compares a precisely known adjustable dc voltage (or a square wave derived from dc) to an unknown ac voltage. If the FTS output remains unchanged when the input switches from the unknown ac voltage to the known dc voltage, the rms value of the ac voltage is equal to the dc voltage. The FTS has extremely flat frequency response and has short term stability approaching 1 part per million (ppm).
- Highly stable thin-film resistor networks scale the 7V range and higher to the FTS 2V operating level and to scale the precision chopped reference to the 0.7 mV level
- An ADC (analog to digital converter) measures the FTS output
- A high-resolution DAC (digital to analog converter) generates precisely variable dc for the ac-dc transfer
- An ultra-stable dc voltage reference establishes DAC accuracy
- A dc-to-square-wave converter chops the DAC output to eliminate dc reversal error in the rms sensor

FUNCTIONAL BLOCK DIAGRAM DISCUSSION 2-3.

Refer to part 1 of Figure 2-1, the functional block diagram. The ac signal to be measured is applied to the FTS first through attenuators (precision resistor networks switched in or out depending on range), the transfer switch, and precision amplifiers (again depending on range). The A/D Amplifier (A15 assembly) measures the output of the FTS. In the block diagram this measurement is called M1.

The next step in the transfer process is shown in part 2 of Figure 2-1. The system takes another measurement, called M2. The CPU sets the precision DAC (digital to analog converter) to approximately the same voltage as the output of the divider network for M1. This voltage is converted to a 28-Hz square wave by the precision chopper circuit and applied to the FTS through the transfer switch and the same range amplifier. The output of the FTS is measured again to yield M2.

In Wideband mode, the option 5790A-03 Wideband module takes over the function of the Transfer assembly. The chopped reference from the A/D Assembly is 80 Hz for Wideband mode. The Wideband assembly is ac-coupled, therefore does not make ac-dc transfers.

Refer to the flowchart (part 3 of Figure 2-1) in the block diagram. After M1 and M2 are taken, the CPU computes the value of the unknown ac voltage at the input, called Vac, using the following formula:

```
Vac = Vdc + (M2 - M1)
```

If Vac and Vdc closely agree, the results are displayed on the front panel and the measurement is complete. If the difference between Vac and Vdc is too large, the CPU readjusts the DAC based on the above formula and begins another measurement cycle.

Calibration constants to correct for FTS and amplifier frequency response variations are stored in memory and applied to measurements before they are displayed. In order to apply the correct constants, a frequency counter measures the frequency of the incoming signal.

DIGITAL SECTION OVERVIEW 2-4.

The unguarded Digital Section contains the CPU assembly (A20), Digital Power Supply assembly (A19), Front Panel assembly (A2), Keyboard assembly (A1), and the Rear Panel I/O assembly (A21). Figure 2-2 is a block diagram of the digital section of the 5790A.

Power for the digital assemblies and the cooling fans is supplied by the Digital Power Supply assembly.

The CPU (central processing unit) assembly is a single-board computer based on the 68000 microprocessor. It controls local and remote interfaces, as well as serial communications over a fiber-optic link to the guard crossing portion of the Regulator/Guard Crossing assembly (A17). The guard crossing controls the guarded analog circuitry.

A Keyboard assembly provides the user with front-panel control of the 5790A. It contains six keycap LEDs and a keypad. It connects to the Front Panel assembly via a cable.

The Front Panel assembly provides information to the user on an Measurement Display and a Control Display. The Front Panel also contains circuitry that scans the keyboard and encodes key data for the CPU.

The Rear Panel I/O assembly includes digital interfaces for the IEEE-488 bus and RS-232-C.

ANALOG SECTION OVERVIEW 2-5.

The guarded analog section of the 5790A contains the following assemblies:

- Filter (A18)
- Regulator/Guard Crossing (A17)
- Transfer (A10)
- A/D Amplifier (A15)
- DAC (A16)
- Wideband (A6, Option -03)

These analog assemblies are interfaced to the Analog Motherboard assembly (A3). The guarded digital bus generated by the guard crossing portion of the Regulator/Guard Crossing assembly controls all analog assemblies except the Filter. The Guard Crossing interfaces with the unguarded CPU assembly via a fiber-optic link. The Transformer assembly, together with the Filter assembly and the regulator portion of the Regulator/Guard Crossing assembly, create the system power supply for all the analog assemblies.

SYSTEM INTERCONNECT DETAILED CIRCUIT DESCRIPTION 2-6.

The motherboard assembly contains the Digital Motherboard assembly (A4), and the Analog Motherboard assembly (A3). These two Motherboards are mechanically

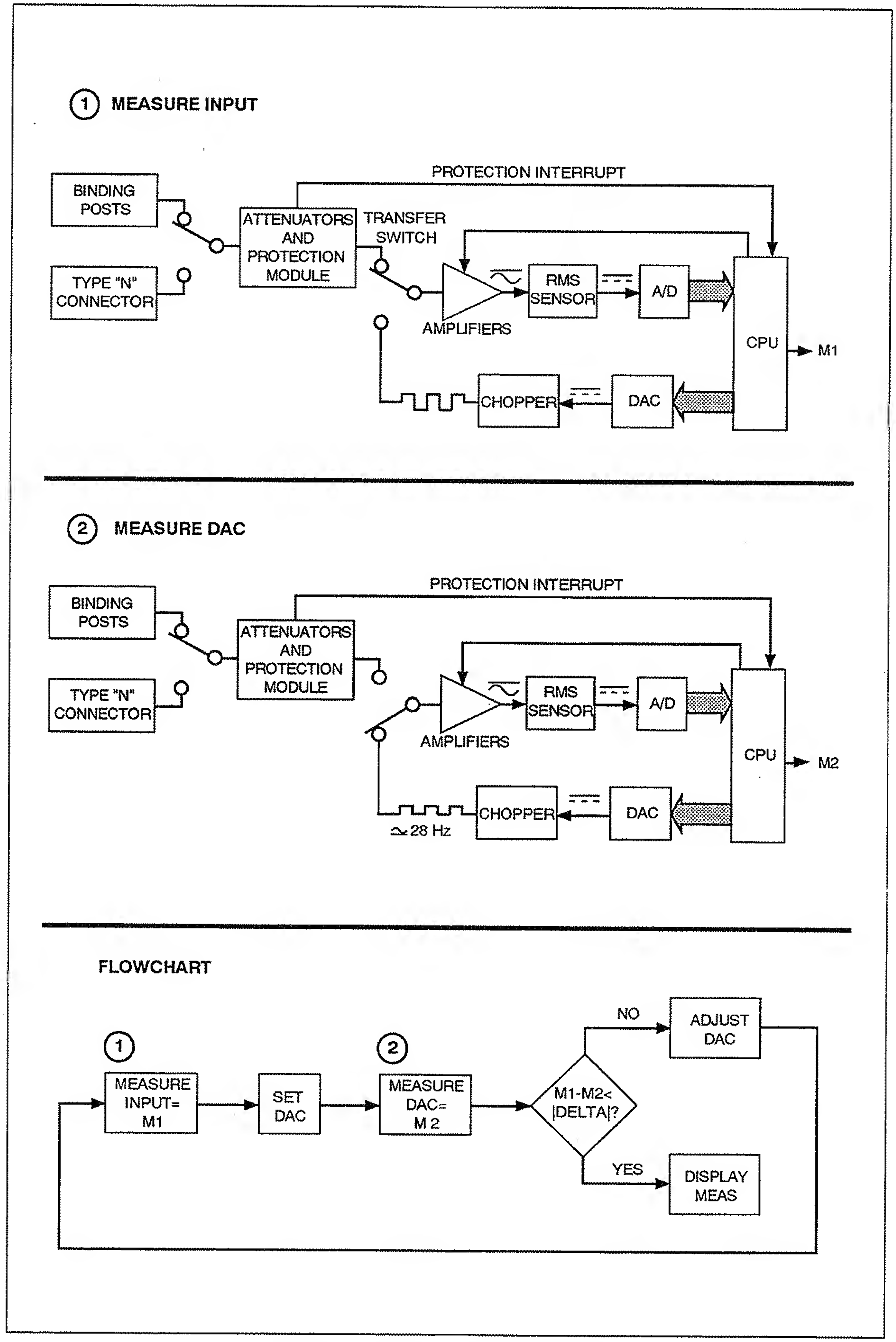

Figure 2-1. Functional Block Diagram

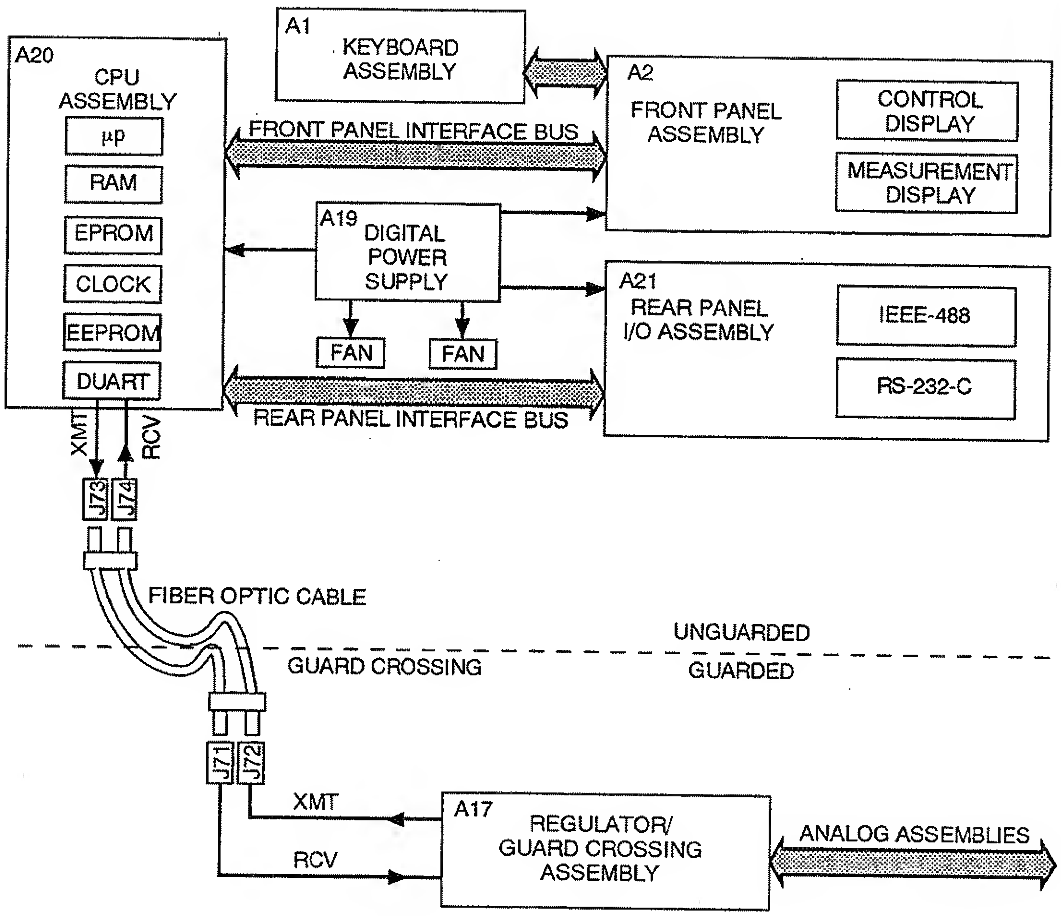

Figure 2-2. Digital Section Block Diagram

fastened together with screws. They are electrically connected by connectors P81 and P82 on the Digital Motherboard and connectors J81 and J82 on the Analog Motherboard. AC voltage taps from the Transformer assembly (A22) are connected to the Analog Motherboard through these connectors. Refer to the Motherboard and Input Block schmatic diagrams for more information.

Digital Motherboard Assembly (A4) 2-7.

The Digital Motherboard contains the line-select switches, line fuse, power switch, a fiber-optic transmitter (J73), and a fiber-optic receiver (J74). It also contains connectors for the Transformer assembly (A22), Digital Power Supply assembly (A19), CPU assembly (A20), Front Panel assembly (A2), Rear Panel assembly (A21), and the two 24V dc fans mounted in the chassis.

The fiber-optic receiver and transmitter provide the serial communication link between the CPU on the unguarded Digital Motherboard and the Regulator/Guard Crossing on the guarded Analog Motherboard.

Transformer Assembly (A22) 2-8.

The Transformer assembly receives ac line inputs routed through the A4 Digital Motherboard. This assembly supplies outputs throughout the 5790A, all of which are routed through the A4 Digital Motherboard.

The Transformer assembly, the Filter assembly (A18), and the regulator portion of the Regulator/Guard Crossing assembly (A17) create the system power supply for all analog assemblies. The Transformer assembly also supplies ac voltages to the Digital Power Supply assembly which generates five regulated dc voltages for use by the CPU, Front Panel assembly, Rear Panel I/O assembly, and the cooling fans.

Analog Motherboard Assembly (A3) 2-9.

The Analog Motherboard contains the connectors for all assemblies in the guarded section of the 5790A. The Analog Motherboard also contains five relays, a fiber-optic transmitter, a fiber-optic receiver, and a cable for binding post connections. Table 2-1 lists Analog Motherboard connectors.

The fiber-optic transmitter (J72) and the fiber-optic receiver (J71) provide the serial communication link between the Regulator/Guard Crossing assembly and the CPU assembly on the unguarded Digital Motherboard.

Table 2-1. Analog Motherboard Connectors

MOTHERBOARD CONNECTOR	CONNECTED TO ASSEMBLY
J106 and J206	Wideband (A6, Option -03)
J110 and J210	Transfer (A10)
J115 and J215	A/D Amplifier (A15)
J116 and J216	DAC (A16)
J117 and J217	Regulator/Guard Crossing (A17)
J118 and J218	Filter (A18)

The cable from the motherboard to the binding posts consists of three insulated wires and four shields.

Rear Panel I/O Assembly (A21) 2-10.

The Rear Panel I/O assembly provides the RS-232-C and IEEE-488 interface connections.

REAR PANEL POWER SUPPLIES 2-11.

Supplies +5V LOGIC, +12V, and -12V are referenced to +5V LOGIC COMMON and are generated on the Digital Power Supply assembly (A19). Some ICs on the A21 assembly do not have power and ground pins shown on the schematic. This information is included in the table on sheet 1 of the Rear Panel schematic.

REAR PANEL DIGITAL CONTROL 2-12.

The rear panel decodes address lines from the bus connected to the main CPU through connector J121. Decoding is accomplished with a C22V10 PLD (U8).

CLOCK REGENERATION CIRCUIT 2-13.

In order to minimize EMI (electro-magnetic interference) inside the 5790A chassis, the rear panel accepts a low-level (~200 mV p-p sine wave) 3.68 MHz clock from the CPU assembly and conditions it to proper TTL clock levels.

This is done by a differential amplifier, U18, which amplifies the incoming signals 3.6864MHZCLK and 3.6864MHZCLK*. The output of U18 is a TTL level 3.68 MHz clock called RP3.68MHZ that is buffered by PLD U8 creating RPCLK for use by DUART (dual universal asynchronous receiver/transmitter) U5, and IEEE interface IC U2.

IEEE-488 (GPIB) INTERFACE 2-14.

The IEEE-488 (GPIB) interface circuit provides the interface between the IEEE-488 connector (J1) and the 5790A processor on the CPU (A20) assembly. The circuitry uses a TMS9914 (U2) General Purpose Interface Bus (GPIB) adapter to meet the requirements for talker/listener operation on the IEEE-488 bus. This circuit translates asynchronous 8 bit data and control information, under control of an external controller, and converts this information to an acceptable format for the CPU.

The TMS9914 has internal circuitry which handshakes in the proper GPIB protocol and stores data in an internal buffer. This IC also has the capability of interrupting the CPU. The CPU can then handle the interrupt through its own handler routine. The data lines between U2 and J1 are buffered by a 75160A (U3) data buffer, and the command lines are buffered by a 75162A (U4) command buffer. J1 is a standard IEEE-488 connector. The shell of this connector is tied to chassis ground for EMI/RFI shielding.

RS-232-C INTERFACE 2-15.

The RS-232-C interface circuit uses a 68C681 DUART (U5), a 1488 line driver (U6), and a 1489 line receiver (U7). Figure 2-3 shows the RS-232 connector pinout (rear panel view).

The DUART does the parallel/serial data conversion and provides two channels of serial RS-232-C communication. One channel is not used.

The other channel is available to RS-232-C connector J2 to meet serial interface needs between the 5790A and the external world. The transmit line (*TXDA) is driven by

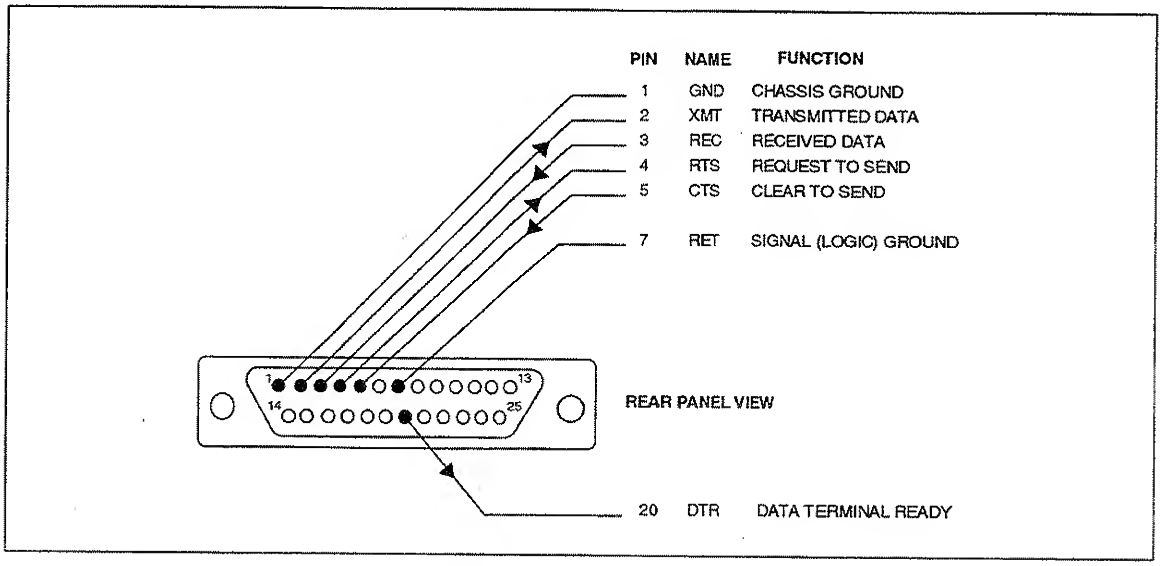

Figure 2-3. RS-232 Connector Pinout

U6D to TX of J2, pin 2. The receive line RX goes from J2, pin 3 through receiver U7C to the receive line *RXDA of the DUART.

The DUART (U5) also has six input lines, three of which monitor signals CTSA*, CAL SWA*, and CAL SWB*. The CTS (clear to send) line from J2, pin 5 goes through receiver U7A becoming CTSA*. Line CAL SWA* connects to the rear panel CALIBRATION STORE switch. Line CAL SWB* connects to the rear panel CALIBRATION MODE switch. Output lines (transmitted data, RTS*, *DTR) are as shown in the connector pinout view.

REAR PANEL CPU INTERFACE 2-16.

The rear panel is interfaced to the CPU assembly (A20) via connector J121 on the rear panel. The CPU has:

- Five address lines (RPA1-RPA5) which comprise the ADDRESS BUS
- Seven control lines which comprise the CONTROL BUS
- A low-level 3.6864 MHz clock (CLOCK, CLOCK*)
- Eight data lines RPD0-RPD7

Interfacing between the Rear Panel data bus (D100-D107) and the CPU data bus (RPD0-RPD7) is done with a bus transceiver U1.

DIGITAL SECTION DETAILED CIRCUIT DESCRIPTION 2-17.

Detailed descriptions of each assembly in the digital section are provided next.

Digital Power Supply Assembly (A19) 2-18.

The Digital Power Supply assembly receives ac voltages from the transformer and provides five regulated dc voltages for use by the CPU, Front Panel assembly, Rear Panel I/O assembly, and the cooling fans. All power supply voltages are referenced to COMMON, which is the transformer center tap for the ±12V supplies. Test points at the top of the assembly can be used to check unregulated input voltages, and regulated dc output voltages. Table 2-2 lists the supplies generated by the Digital Power Supply.

+5V POWER SUPPLY 2-19.

The unregulated +5V supply uses CR25-CR28 in a full-wave rectifier configuration with filter capacitors C12, C13, and C14. Other components in the circuit filter high-frequency noise and provide a common-mode choke. Regulator U3 is fused by 3.15A slow-blow fuse F5.

±12V POWER SUPPLIES 2-20.

Full-wave rectifiers and filter capacitors generate the unregulated +12V and -12V supplies. AC inputs are fused by F3 and F4, both 2A slow blow. Three-terminal +12V and -12V regulators (U1 and U2, respectively) are used. Diodes protect the regulator from input shorts and from reverse voltage. Inductors L3-L6 filter the regulated outputs. Resistor R7 further isolates the ±12V FAN lines from the ±12V power lines. The +12V FAN and -12V FAN lines power the two 24V dc fans inside the 5790A.

+35V POWER SUPPLY 2-21.

The +35V power supply powers the grid drivers and anode drivers on the front panel Measurement Display circuitry. The +35V supply is full-wave rectified, and regulated by Zener diodes VR14, VR15, and transistor Q5. The input is fused by F2, a 0.125A slow-blow.

Components R5 and Q6 make up the current-limiting circuit. During an over-current condition, the voltage drop across R5 turns Q6 on, thus drawing current away from the base of Q5 and limiting current flow to the output. Diode CR16 protects this circuit from reverse voltage.

+75V POWER SUPPLY 2-22.

The +75V power supply powers the grid drivers and anode drivers on the front panel control display circuitry. The +75V supply is full-wave rectified, then regulated by 36V zener diode VR6, 39V zener diode VR7, and transistors Q1 and Q3. Zener diodes VR6 and VR7 set the output voltage. Transistors Q1 and Q3, in a Darlington configuration for current gain, are used as an emitter follower. Transistor Q4, zener diode VR5, and resistors R2 and R3 make up the constant current source supplying current to the zener diodes and the base of Q3. Current limiting is performed by R1 and Q2 in the same manner as in the +35V supply. Diode CR8 protects the circuit from reverse voltage.

+35V AND +75V SHUT-DOWN CIRCUIT 2-23.

The +35V and +75V high voltage supplies are shut down when a fault occurs in the control display refresh circuitry. This shut-down circuit prevents the Control Display

Table 2-2. Supplies Generated by the Digital Power Supply

SIGNAL NAME	TEST POINT	NOMINAL OUTPUT	TOLERANCE	CURRENT LIMIT	RATED OUTPUT
+75V OUT	TP2	73V	±8%	121 mA	100 mA
+35V OUT	TP5	35V	±7%	52 mA	40 mA
+12 VOLTS	TP8	12V	±5%	1.5A	700 mA
-12 VOLTS	TP10	12V	±5%	1.5A	450 mA
+5V	TP12	5.2V	±5%	2.4A	2.0A
COMMON	TP13				

and Measurement Display from burning out, and also verifies that the master clock is generating control signals for both displays.

During normal operation, 75VSD is low, turning Q10 off. Line RESETL pulls the base of Q9 high through R9, turning Q9 on. This action in turn pulls the junctions of CR31-CR32 and CR33-CR34 low, turning Q7 and Q8 off. The +75V and +35V constant-current sources can then supply the appropriate zener diodes and drive the bases of the respective emitter followers.

When a display refresh fault occurs, the 75VSD line on P119 pin 5C, coming from the Front Panel assembly, goes high. This signal, pulled up by R4, drives the base of Q10 through base resistor R11. Transistor Q10 then pulls the base of Q9 near ground, turning Q9 off. On power-up or during a CPU reset, the RESETL signal is low, pulling the base of Q9 near ground through R9, also turning Q9 off. Resistor R12 is a turn-off resistor for Q9. Diodes CR31 and CR33 are in a wired-OR configuration. When Q9 is saturated (on), CR31 and CR33 pull their respective junctions to CR32 and CR34 near ground, turning Q7 and Q8 off. When Q9 is off, the junctions are pulled high through R8 and R10, saturating Q7 and Q8 (on). When on, Q7 removes the base drive from Q3, shutting down the +75V supply. Similarly, Q8 removes the base drive from Q5, shutting down the +35V supply.

Diodes CR32 and CR34 simply ensure that Q7 and Q8 are off when Q9 is on. Resistor R8 guarantees that Q7 will hold the +75V supply off until it drops below 15.6V, and R10 holds the +35V supply off to 7.8V.

CPU Assembly (A20) 2-24.

The CPU (Central Processing Unit) for the 5790A is a single-board computer based on a 68HC000 microprocessor. Figure 2-4 is a block diagram of the CPU assembly. Table 2-3 is a glossary of CPU acronyms that you may find helps to read the schematic diagram. The CPU assembly communicates with the Guarded Digital section, the Front Panel assembly, and the Rear Panel assembly. The board can be divided into three primary areas:

- The microprocessor and its support circuitry
- Memory
- Peripheral ICs and I/O interfaces

Microprocessor support circuitry consists of a power-up and reset circuit, clock generation, a watchdog timer, address decoders and DTACK (data acknowledge) generator, bus error timeout, and interrupt controller.

POWER-UP AND RESET CIRCUIT 2-25.

The power-up and reset circuitry consists of line monitor IC U1, C5, C6, CR1, R3, Z3, switch SW1, and inverters on U2. This circuit provides a 195 ms reset pulse at power-up or upon pressing and releasing SW1, placing the CPU assembly in a known safe condition. If the power supply glitches or falls below 4.55V ±0.05V, U1 resets the 5790A. The reset pulse duration is determined by C5. Note that SW1 performs a different function than the front panel RESET button. SW1 is a hardware reset that is hard-wired to and directly read by the microprocessor. The front panel RESET button is a software reset; it tells the system software to restore the 5790A configuration to a default condition.

The heart of this circuit is the line monitor IC U1. On power-up or when SW1 is pushed, U1 forces an active-low reset pulse on RESETL and an active-high pulse on RESET. RESETL helps to prevent accidental writes to EEPROM and drives an inverter

Table 2-3. CPU Acronym Glossary

SIGNAL NAME	FUNCTION
A01-A23	Address lines
ADCLKCS*	Clock/calendar (U33) chip select
AS*	Address strobe
BERR*	Bus error
BGACK*	Bus grant acknowledge
BR*	Bus request
BRPDRTINT*	Rear panel DUART interrupt
BRPDTK*	Rear panel data transfer acknowledge
BRPIEEEINT*	Rear panel IEEE-488 interrupt
CLKCALINT*	Clock/calendar interrupt
D00-D15	Data lines
DOGCLR	Dog clear (clears watchdog timer)
DOGINTH	Dog interrupt (interrupt from watchdog timer)
DRTDTK*	DUART data transfer acknowledge
DTACK*	Data transfer acknowledge
E	Enable for 6800 family devices (737.28 kHz clock)
EXDUARTINT*	External DUART Interrupt
FAN1	Signal monitoring fan 1
FAN2	Signal monitoring fan 2
FANINT*	Fan monitor interrupt
FC0	Function code output 0
FC1	Function code output 1
FC2	Function code output 2
FPDTK*	Front panel data transfer acknowledge
FRNTPNLCS*	Front panel chip select
FRNTPNLEN*	Front panel enable
GCDRTCS*	Guard crossing DUART chip select
GCDUARTINT*	Guard crossing DUART interrupt
INTRCNTL1	Interrupt control 1
INTRCNTL2	Interrupt control 2
IPL0*	Interrupt priority level 0
IPL1*	Interrupt priority level 1
IPL2*	Interrupt priority level 2

Table 2-3. CPU Acronym Glossary (cont)

SIGNAL NAME	FUNCTION
KEYBRDINT*	Keyboard interrupt
LDS*	Lower data strobe
MISCCS*	Miscellaneous chip select enable (upper address bits decoder)
NVMCS*	Nonvolatile memory chip select
NVMOE*	Nonvolatile memory output enable
PROM0CS*	PROM 0 chip select (U15 and U16)
PROM1CS*	PROM 1 chip select (U17 and U18)
PROM2CS*	PROM 2 chip select (U23 and U24)
PSFAILINT*	Power supply fail interrupt
RAM0CS*	RAM chip select (U19 and U20)
RAM1CS*	RAM chip select (U21 and U22)
RAM2CS*	RAM chip select (U40 and U41)
R/WR*	Read/write
RDINT*	Read interrupt
RDL*	Read data lower
RDU*	Read data upper
RDY/BSYL	Ready/busy
RPSEL*	Rear panel chip select
RRPNLEN*	Rear panel enable
RXDA	Receive Data Port A
RCVB	Receive Data Port B
SCLK	Serial clock
TXDA	Transmit Data Port A
TXDB	Transmit Data Port B
UDS*	Upper data strobe
WRL*	Write lower
WRU*	Write upper
XDUARTCS*	External DUART chip select

in U2 to turn off LED CR1. CR1 indicates that the +5V supply is on and that the CPU is operating, i.e. not reset. RESETL also resets the rear panel assembly. The other output, RESET, drives two inverters in U2. One of these inverters provides HALT*. The other generates IORESET*, which drives the processor's RESET, and provides a reset for the front panel interface and DUARTs (dual universal asynchronous receiver/transmitter) circuitry.

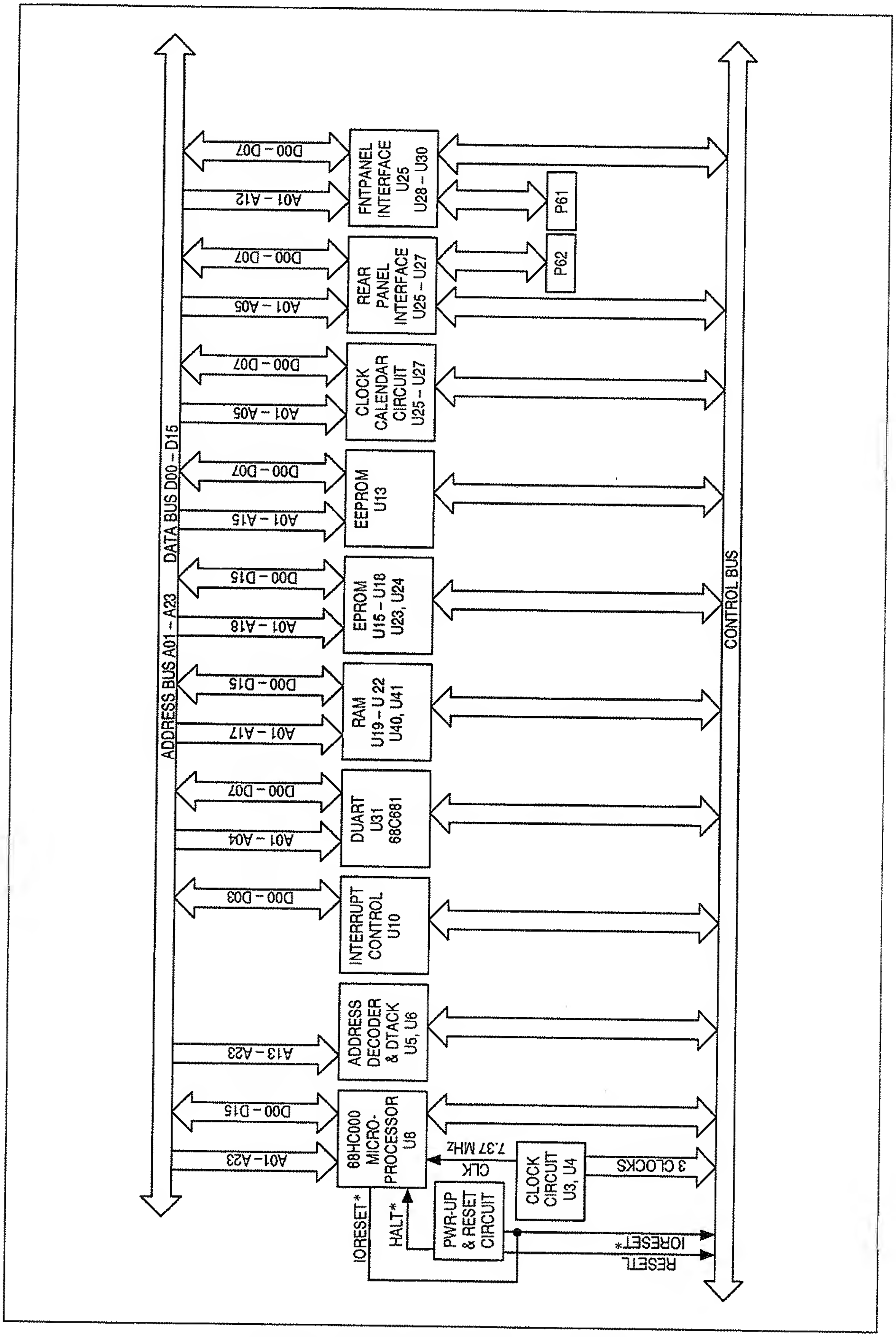

Figure 2-4. CPU Assembly Block Diagram

CLOCK GENERATION 2-26.

The clock generation circuit uses components Y1, Y2, U3, U4, R4, R5, C8, C9, and E5. The crystal Y1, along with the resistors, capacitors, and an inverter in U3 generates the 7.3728 MHz primary system clock CLK. This system clock is used by the processor and is divided down by a binary counter (U4) for clocks of 3.6864 MHz, 28.8 kHz, and 450 Hz. The 450 Hz clock is used by the watchdog timer, the 28.8 kHz is used by U6 in the decoding circuit, and the 3.6864 MHz is used by the DUARTs, and the clock filter circuit. Jumper E5 allows for selection of the alternate oscillator (Y2) as the system clock.

WATCHDOG TIMER 2-27.

The watchdog timer circuitry uses a 74HC4020 binary counter (U11) to divide the 450 Hz from the clock generation circuit to produce interrupt DOGINTH, signifying that the system may be locked up. This interrupt is generated 1.14 seconds after the last DOGCLR2 signal from interrupt controller U10. Therefore, DOGCLR2 must occur more often then every 1.14 seconds to clear U11 and prevent the watchdog interrupt. Generation of DOGCLR2 is under software control. The watchdog timer can be disabled by cutting jumper E1.

ADDRESS DECODING AND DTACK (DATA ACKNOWLEDGE) 2-28.

Two Programmable Logic Devices (PLDs) accomplish address decoding and DTACK (data acknowledge) generation. ICs U5 and U6 provide chip selects and generate acknowledgement signals for those devices without DTACK lines. IC U5 receives DTACK signals from the asynchronous devices and ORs these signals together to form DTACK*. Table 2-4 is the memory map for the system. It shows the chip select, address range, and notes whether AS* (address strobe) or LDS* (lower data strobe) is required.

Table 2-4. CPU Memory Map

CHIP SELECT	READ/WRITE	ADDRESS RANGE	AS* OR LDS* REQUIRED?
PROM0CS*	R	0 to 3FFFF	no
PROM1CS*	R	40000 to 7FFFF	no
PROM2CS*	R	80000 to BFFFF	no
RAM0CS*		600000 to 60FFFF	no
RAM1CS*		610000 to 61FFFF	no
RAM2CS*		620000 to 623FFF	no
NVMCS*	R/W	C00000 to CFFFFF	no
MISCCS*	R/W	D00000 to DFFFFF	no
RPSEL*	R/W	D00000 to D01FFF	LDS*
RPDUARTCS*	R/W	D00000 to D0001F	LDS*
RPIEEECS*	R/W	D00020 to D0002F	LDS*
FRNTPNLCS*	R/W	D02000 to D03FFF	AS*
OTDCS*	R/W	D02000 to D027FF	AS*
DMDCS*	R/W	D02800 to D02FFF	AS*
LED-OUTPUT-CNTRL	R	D03400 to D037FF	AS*

Table 2-4. CPU Memory Map (cont)

CHIP SELECT	READ/WRITE	ADDRESS RANGE	AS* OR LDS* REQUIRED?
LED-LATCH-EN	W	D03400 to D037FF	AS*
KEYBOARDCS*	R/W	D03800 to D038FF	AS*
GCDRTCS*	R/W	D04000 to D05FFF	LDS*
XDUARTCS*		D06000 to D07FFF	LDS*
RDINT*	R/W	D08000 to D09FFF	AS*
DOGCLR	W	D08000 to D09FFF	even only, AS*
ADCLKCS*		E00000 to EFFFFF	AS*

INTERRUPT CONTROLLER 2-29.

PLD U10 is the priority interrupt controller. The interrupt controller reads incoming interrupts and interrupt control lines, then encodes the highest priority interrupt into the interrupt level for the 68HC000. When the 68HC000 responds to an interrupt request, it asks the interrupt controller for an 8-bit vector that corresponds to the pending interrupt of highest priority. The interrupt controller responds with the 4 LSBs of the vector according to how it is programmed. The 4 MSBs are pulled up on resistor network Z1. Table 2-5 shows the interrupts, their priority levels, and vectors.

GLUE LOGIC 2-30.

ICs U2, U3, and U9 form the glue logic circuit, which keeps various CPU functions running properly. The four OR gates in U9 and an inverter in U3 use control signals UDS*, LDS*, and R/WR* from the microprocessor to generate control signals WRU*, WRL*, RDL*, and RDU*.

Table 2-5. CPU Interrupts, Priorities, and Vectors

INTERRUPT	PRIORITY LEVEL	VECTOR (HEX)
NMI	7	- (not used)
DOGINTH	6	F4
BRPDRTINT*	5	F6
GCDUARTINT*	5	F7
EXDUARTINT*	5	F8
CLKCALINT*	4	F5
BRPIEEEINT*	4	F9
KEYBRDINT*	3	FA
BPSFAILINT*	2	FB
FANINT*	0	FF (not used)
RDY/BSYL	0	FF (not used)
No interrupt	0	FF

RAM (RANDOM-ACCESS MEMORY) 2-31.

Random-access memory is contained in three pairs of sockets, U19 and U20, U21 and U22, and U40 and U41. These sockets accommodate either 32K x 8 or 128K x 8 static CMOS RAM modules (32 KB or 128 KB each). The 5790A is shipped with U19-U22 installed, using 32K x 8 parts and providing 128 KB of static RAM.

ROM (READ-ONLY MEMORY) 2-32.

Read-only memory is contained in three pairs of sockets, U15-U16, U17-U18, and U23-U24. These sockets accommodate 27010 EPROMS, 128K x 8 devices (128 KB each). Jumpers allow 256 KB devices to be used in their place. The 5790A is shipped with U15-U18 installed, providing 512 KB of EPROM.

ELECTRICALLY-ERASABLE PROGRAMMABLE READ-ONLY MEMORY (EEPROM) 2-33.

IC U13 is an EEPROM. The socket accommodates a 32K x 8 device (32 KB of storage.) A jumper is provided to allow an 8K x 8 (8 KB) device to be used in place of the 32 KB device. The 5790A is shipped with a 32KB EEPROM installed.

The EEPROMs are designed so that writes to the device are prevented by holding the output enable line (NVMOE*) low. Diodes CR5, CR6 and CR8, together with resistor R6, perform a wired-OR function for three signals that control NVMOE*. Components R6, CR6 and C17 hold NVMOE* to a valid logic low for typically 37.3 ms during power-up; 26.8 ms minimum, 49.6 ms maximum. Diode CR7 provides a discharge path for C17 on power-down, allowing the operator to quickly turn the 5790A off then on again, without interfering with the power-up charge time of the capacitor. Diode CR8 allows the normal microprocessor read of the device to take place. And diode CR5 allows power monitoring IC U1 to hold NVMOE* low when the +5V power supply drops below 4.5V on power-down or during power glitches.

DUART (DUAL UNIVERSAL ASYNCHRONOUS RECEIVER/TRANSMITTER) CIRCUIT 2-34.

The 68C681 DUART (U31) has several functions. Its primary function is to provide the asynchronous serial lines that communicate with the Guarded Digital Controller over the fiber-optic path off the Digital Motherboard. A 75451 driver IC (U32) drives the fiber-optic transmitter on the digital Motherboard.

The DUART has 8 output lines that perform various functions. INTRCNTL1 and INTRCNTL2 go to the interrupt controller and are fed back to the DUART inputs. These are used by the interrupt controller to enable certain interrupts. Line SCLK is a test output of the channel A serial clock.

The DUART monitors the EEPROM ready signal and the FANINT* signal. It also has a spare serial channel that goes to connector J5. Components U44 and U43 convert the TTL-level signals at the DUART to RS-232-C-level signals at J5.

The DUART generates its own DTACK signal, DRTDTK*, which is used by U5 to generate system DTACK, DTACK*. A second DUART, U42, with associated RS-232-C drivers and receivers is used only for test purposes. It generates its own DTACK, wire-ORed to DRTDTK*.

CLOCK/CALENDAR CIRCUIT 2-35.

Time and date information is stored in a battery-backed clock/calendar circuit consisting of 32.768 kHz crystal Y3, 3V lithium battery BT1, clock/calendar IC U33, and capacitors C10 and C11. The clock/calendar IC has the necessary circuitry internally to switch operation from the power supply to battery BT1. Pull-up resistors in Z5 off U33

are to ensure low power operation when the +5V supply is off. U33 generates CLKCALINT* under software control.

CLOCK FILTER CIRCUIT 2-36.

The clock filter circuit generates a 3.6864 MHz 200 mV sine wave for the Rear Panel I/O and Front Panel assemblies. This circuit buffers the 3.6864 MHz Clock with an inverter in U3. The circuit contains dc-blocking capacitor C80, two stages of a low pass LC filter (L80 and C81, L81 and C82), transformer T51, and termination resistor R82.

CPU TO REAR PANEL INTERFACE 2-37.

Components U25, U26, U27, and connector P220 interface the CPU to the rear panel. Bi-directional bus transceiver U26 buffers the data lines. Signal R/WR* controls the transmission direction of the data lines, and RRPNLEN* is the IC enable. IC U25 buffers control lines BRPDRTINT*, BRPIEEEINT*, and BRPDTK*. U27, enabled by RRPNLEN*, buffers address line A01-A05 and control lines WRL* and R/WR*. Control lines RESETL, RPSEL*, TXDB, RCVB, and XMT go directly to connector P220.

CPU TO FRONT PANEL INTERFACE 2-38.

Components U25, U28, U29, U30 and connector P120 interface the front panel to the CPU. Bi-directional bus transceiver U30 buffers the data lines. Control signal R/WR* controls the transmission direction of the data lines, and FRNTPNLEN* is the IC enable. IC U28, enabled by FRNTPNLEN*, buffers address lines A05-A12. IC U29, also enabled by FRNTPNLEN*, buffers address lines A01-A04 and control line R/WR*. Two sections of U25 in parallel buffer IORESET*, providing twice the drive current of a single section, generating BRESET*. Three other sections of U25 buffer FPINT*, FPDTK*, and PSFAILINT*. Control line FRNTPNLCS* goes directly to connector P120.

Front Panel Assembly (A2) 2-39.

The Front Panel assembly, operating in conjunction with the Keyboard assembly (linked by a cable), is the operator interface to the 5790A. This assembly contains two separate vacuum-fluorescent displays: the Control Display and the Measurement Display. Each display has its own control, high voltage drive, and filament-switching circuits. This assembly also contains clock regeneration, refresh failure detect, keyboard scanner, LED drive, and decoding and timing circuitry.

Connector J1 interfaces with the CPU assembly and the Digital Power Supply assembly via the Digital Motherboard.

CLOCK REGENERATION CIRCUITRY 2-40.

To minimize EMI (electro-magnetic interference), the Front Panel assembly accepts a low-level sine-wave (approximately 200 mV p-p) 3.6864 MHz clock from the CPU assembly and converts it to a TTL-acceptable level. This is done by high-speed differential comparator (U7A), operating on incoming signals 3.6864MHZCLK and 3.6864MHZCLK*. The output of U7A is the input to U8 and is also inverted by U11B to create the 3.6864 MHz clock signal CLOCK. Twelve-stage binary counter U8 divides the 3.6864 MHz clock by eight and U11A inverts the signal to create 460.8 kHz. The master clock is further divided by U8, producing a 900-Hz signal on pin 1. These clocks provide system timing for the other ICs on the assembly. A -5.2V supply for U7 is provided by VR5, with C64 acting as the supply bypass.

REFRESH FAILURE DETECT CIRCUITRY 2-41.

If a clock failure were to occur, the refresh cycles of the vacuum-fluorescent displays would be interrupted. This condition could damage the tubes if not immediately

detected. Refresh failure detect circuitry monitors the GRIDDATA output from the last high voltage driver (U23) for the Control Display. This output (REFRESH) is used to clear a watchdog timer (U6) every refresh cycle. If the refresh is interrupted and GRIDDATA does not occur, the watchdog timer times out and latches U12.

Flipflop U12 generates control lines 75VSD and PSFAILINTR*. Control line 75VSD is routed to the Digital Power Supply assembly to shut down the +35V and +75V power supplies, thus preventing damage to the vacuum-fluorescent displays. Interrupt line PSFAILINTR* is used by PLD U3 to properly blank the Control Display and Measurement Display through DMDBLANK and OTDBLANK, and alerts the CPU that this failure has occurred.

DECODING AND TIMING CIRCUITRY 2-42.

Main decoding and master timing functions for the front panel are accomplished by an EP900 PLD (Programmable Logic Device), U3. Two state machines control display refresh and filament switching. Filament switching is handled by two non-overlapping 57.6 kHz signals.

Signals GSTRBE and STROBE are master timing and synchronization signals used by the other ICs. Signal DMDBLANK controls the Control Display grid drivers, ABCLK and CDCLK control the Control Display anode drivers, and OTDBLANK controls the Measurement Display grid and anode drivers. Front panel DTACK and interrupt functions, and generation of the various chip select and reset signals are also provided by U3. Table 2-6 is a memory map for the front panel.

CONTROL DISPLAY CIRCUITRY 2-43.

Control Display circuitry consists of a 26-row by 256-column vacuum-fluorescent dot matrix display under the control of PLD U4, four high voltage grid drivers (U20-U23), four high voltage anode drivers (U16-U19), a filament switching circuit, and 1K x 8 (1 KB) dual-port RAM U1.

This display is divided into 129 grids; alternate grids contain two anode columns lettered B C or D A. Grid G129 and column C in grid G128 are not used. Each column contains 26 individual anodes.

IC U4 is an EP900 Programmable Logic Device (PLD). It provides the timing and control signals for Control Display circuitry. Display data written by the microprocessor into the Control Display's dual port RAM (U1) is read by U4 and sent serially to the high voltage anode drivers. Both the anode and grid drivers are serial TTL-level input, 32-bit parallel high voltage output devices. IC U4 also controls the grid timing and display refresh.

Table 2-6. Front Panel Memory Map

NAME	READ/WRITE	ADDRESS
OTDCS*	R/W	D02000 to D027FF
DMDCS*	R/W	D02800 to D02FFF
LED_OUTPUT_CNTRL	R	D03400 to D037FF
LED_LATCH_EN	W	D03400 to D037FF
KEYBOARDCS*	R/W	D03800 to D03BFF

```
**************     *************     *************
*            *     *           *     *           *
*   B    C   *     *  D    A   *     *  B    C   *
*            *     *           *     *           *
*     G4     *     *    G5     *     *    G6     *
*            *     *           *     *           *
**************     *************     *************
```

Adjacent columns in adjacent grids are driven, while the opposite columns are turned off. For instance, grid G4 contains columns B and C, and grid G5 contains columns D and A. G4 and G5 are driven simultaneously while anode columns G4-C and G5-D are activated, and G4-B and G5-A are driven off. Next, grids G5 and G6 are driven simultaneously, while columns G5-A and G6-B are activated, and G5-D and G6-C are driven off. This pattern is repeated for all 128 grids at a refresh rate of about 75 Hz.

Both the A and C (U16 and U18), and B and D (U17 and U19) anode drivers' input registers are latched with the same data, while the output drivers are appropriately enabled and displaying the data previously strobed to the driver outputs from the input registers. The input register data is strobed to the output drivers while all of the drivers are disabled, or blanked. Following this, either the A and B drivers are enabled to display the A-B data, when the C and D drivers, latched with A-B data, are disabled, or the C and D drivers are enabled to display the C-D data, when the A and B drivers, latched with C-D data, are disabled.

Control Display filament driver circuitry consists of transistors Q1 through Q6 and zener diodes VR1 and VR2, with associated resistors. The transistors are driven by 7406 open collector drivers U13B and U13A. These drivers are controlled by AOUT and BOUT. AOUT and BOUT are synchronous, non-overlapping, three-eighths duty cycle, 57.6 kHz timing signals generated by U3. Each signal is alternately active high for 6.51 µs, with a dead time between active signals of about 2.17 µs to allow for turn-off times of the drive transistors. When AOUT is high, U13B turns Q2 and Q4 on. Q4 turns Q6 on, providing a path for the filament current through Q2 and Q6. Zener diode VR2 provides the dc voltage offset necessary for proper filament operation. Then when BOUT is high, U13A turns Q1 and Q3 on. Q1 turns Q5 on, providing a path for the filament current through Q3 and Q5, effectively reversing the direction of the voltage driving the filament. Zener diode VR1 provides the dc voltage offset necessary for proper filament operation.

PLD U4 also generates the 225 Hz square-wave SCAN signal used by PLD U9 to control front panel keypad scanning and key debounce.

Dual-port RAM U1 contains all the Control Display data written by the 68HC000 microprocessor on the CPU board. PLD U4 contains a 10-bit address counter which is used by U4 to read the contents of U1. U1 provides a BUSYD signal to U3, which is active low whenever the CPU and U4 try to access the same RAM location at the same time. If the microprocessor attempts to write to the RAM location that U4 is reading (as it refreshes the DMD), U3 uses BUSYD to hold off DTACK to the microprocessor. This prevents the written data from being lost. The other busy signal, generated when U4 attempts to read from a location being written to by the microprocessor, is ignored. Losing display data for one refresh cycle is insignificant.

MEASUREMENT DISPLAY CIRCUITRY 2-44.

Measurement Display circuitry consists of a custom 2-row, 22-character vacuum-fluorescent display under the control of PLD U5. The circuit contains high voltage grid driver U15, high voltage anode driver U14, a filament switching circuit, and a 1K x 8 (1 KB) dual-port RAM, U2.

The custom display is divided into 24 grids. The 22 characters are made up of fourteen seven-segment digits and eight 14-segment characters. See the schematic diagram for more information.

IC U5 is an EP900 PLD, programmed to provide the timing and control signals for the Measurement Display circuitry. Display data written by the microprocessor into the Measurement Display's dual-port RAM U2, is read by U5 and sent serially to the high voltage anode driver. Both the anode and grid drivers are serial TTL-level input, 32-bit parallel high voltage output devices. Only 31 anode driver outputs and 24 grid driver outputs are used, the remaining high voltage outputs are left unconnected. IC U5 also controls grid timing and display refresh.

Measurement Display filament driver circuitry centers on transistors Q7-Q12. The transistors are driven by 7406 open-collector drivers U13C and U13D. These drivers are controlled by AOUT and BOUT as in the Control Display. When AOUT is high, U13C turns Q8 and Q10 on. Q10 turns Q12 on, providing a path for the filament current through Q8 and Q12. Zener diode VR4 provides the dc voltage offset necessary for proper filament operation. Then when BOUT is high, U13D turns Q7 and Q9 on. Q7 turns Q11 on, providing a path for the filament current through Q9 and Q11, effectively reversing the direction of the voltage driving the filament. Zener diode VR3 provides the dc voltage offset necessary for proper filament operation.

Dual-port RAM U2 contains all the Measurement Display data written by the 68HC000 microprocessor on the CPU board. U5 contains a 7-bit address counter which U5 uses to read the contents of U2. U2 provides a BUSYO signal to U3, which is active low whenever the CPU and U5 try to access the same RAM location at the same time. If the microprocessor attempts to write to the same RAM location U5 is reading as it refreshes the Control Display, U3 uses BUSYO to hold off DTACK to the microprocessor. This prevents written data from being lost. The other busy signal, generated when U5 attempts to read from a location being written to by the microprocessor, is ignored. Losing display data for one refresh cycle is insignificant.

IC U5 also generates the FPINTR* (front panel interrupt, active low) signal sent to the 68HC000 microprocessor, telling it there is a keyboard interrupt. Keyboard interrupt inputs to U5, KEYBOARDINTR (active high), is generated by PLD U9.

KEYBOARD SCANNER CIRCUITRY 2-45.

The key matrix is scanned by PLD U9. It sequentially drives one of the eight columns for about 2.2 ms, then reads all six rows of the matrix on each column scan. When a key is pressed and the column associated with that key is scanned, the row associated with that key goes low. If the key is still pressed after a 6.6 ms debounce period, U9 generates signal KEYBOARDINTR. This signal goes to U5 where it generates FPINTR*, which interrupts the 68HC000 microprocessor. The microprocessor generates KEYBOARDCS* through PLD U3, causing U9 to output encoded row and column data on the data bus for the microprocessor to read. This also resets the keyboard interrupt.

The microprocessor controls the speaker, also referred to as the beeper. Writing a logic high on data line D6 to U9 enables the speaker, writing a logic low on D6 disables the speaker. When enabled, a 900 Hz square-wave signal generated by U8 is gated out to the speaker through U9.

LED CIRCUITRY 2-46.

The LED circuit controls the six keycap light-emitting diodes on the Keyboard assembly. It includes a 74LS373 8-bit latch (U10), and resistors R16 through R19 and R78

through R80. Keycap LEDs light to indicate which input is selected, and to indicate when external trigger mode (EX TRIG) or external guard (EX GRD) is selected.

Latch (U10) is controlled by the LED_LATCH_EN signal from the decoding PLD U3. Signal LED_LATCH_EN latches the CPU data bus into the internal latches of U10 on a write to the front panel LED memory space. This data appears at the output when control line LEDENABLE* goes low. Control line LED_OUTPUT_CNTRL from U3 is inverted by U11C to create LEDENABLE*. Table 2-7 shows which line activates each LED.

Keyboard Assembly (A1) 2-47.

The Keyboard assembly provides the operator with front panel control of the 5790A. It connects to the Front Panel assembly (A2) through a cable, and includes an elastomeric keypad, and six keycap LEDs.

The elastomeric keypad and the printed circuit board form a 45-switch keyboard arranged in eight columns and six rows (only 32 of these keys are used). The keyboard scanner circuit on the Front Panel assembly sequentially drives columns one through eight. When a key is pressed, a low appears on the corresponding row as the key's column is scanned. The keyboard scanner circuit encodes the key's row and column location, then takes appropriate action.

The six keycap LEDs (CR1 through CR6) are controlled by the LED driver circuit on the Front Panel assembly. Refer to the Keyboard schematic for the name of the signal line that controls each keycap LED.

ANALOG SECTION DETAILED CIRCUIT DESCRIPTION 2-48.

Detailed descriptions of each assembly in the analog section are provided here. Simplified schematics are provided to supplement the text.

Filter Assembly (A18) 2-49.

The Filter assembly receives ac inputs from the main power transformer secondaries and provides unregulated dc to the Regulator/Guard Crossing assembly (A17), and regulated dc supplies to the DAC assembly. The unregulated supplies are listed in Table 2-8 and the regulated supplies are listed in Table 2-9.

UNREGULATED CH SUPPLIES 2-50.

Line CH COM is the return path for the +15 CHR and -15 CHR supplies. These supplies use a full-wave center-tapped configuration. They consist of bridge rectifier CR3 and two filter capacitors, C4 and C6, for +15 CHR and -15 CHR, respectively. Inputs are fused with 1.6A slow-blow fuses F1 and F2.

Table 2-7. Control Lines for the Keyboard LEDs

KEYCAP LED	CONTROL LINES
INPUT 2	LED1A
EX GRD	LED2A
WBND	LED2B
SHUNT	LED1B
INPUT 1	LED3A
EX TRIG	LED3B

Table 2-8. Unregulated Supplies from the Filter Assembly

SIGNAL NAME	NOMINAL OUTPUT	TOLERANCE	MAX. P-P RIPPLE	RATED OUTPUT	TEST POINT
+15 CH	27V	±8V	2V	200 mA	TP2
-15 CH	-27V	±8V	2V	200 mA	TP5
OSC COM	RETURN				TP4
+5 LHR	12V	±4V	3V	3.5A	TP1
-5 LHR	-12V	±4V	2V	400 mA	TP6
LH COM	RETURN				TP3
+17 SR	27V	±8V	3V	1.3A	TP10
-17 SR	-27V	±8V	3V	1.3A	TP14
17 S COM	RETURN				TP12
+5 FR1R	12V	±4V	2V	400 mA	TP17
-18 FR1R	-27V	±8V	2V	50 mA	TP20
FR1 COM	RETURN				TP19
+30 FR1R	50V	±15V	3V	85 mA	TP15
FR1R COM	RETURN				TP16
+30 FR2R	-50V	±15V	3V	85 mA	TP8
FR2 COM	RETURN				TP11

Table 2-9. Regulated Supplies from the Filter Assembly

SIGNAL NAME	NOMINAL OUTPUT	TOLERANCE	CURRENT LIMIT	RATED OUTPUT	TEST POINT
-5 FR2	-5V	±0.3V	0.15A	0.03A	TP13
FR2 COM	RETURN				TP11
+5 FR1	+5V	±0.3V	2A	0.1A	TP18
-18 FR1	-18V	±0.9V	2A	0.05A	TP21
FR1 COM	RETURN				TP19

UNREGULATED LH SUPPLIES 2-51.

Line 5 LH COM is the return path for the +5 LHR and -5 LHR supplies. These supplies use a full-wave center-tapped configuration, and consist of four diodes (CR1, CR2, CR4, CR5) configured as a bridge rectifier.

Capacitors C2 and C3 filter +5 LHR, and C5 filters -5 LHR. Capacitor C1 reduces the level of generated transients.

UNREGULATED ±17 SR SUPPLIES 2-52.

The ±17 SR supplies use a full-wave center-tapped rectifier consisting of four diodes (CR8, CR10, CR12, CR13) configured as a bridge rectifier. Capacitors C13 and C14 filter the +17 SR supply, while C15 and C16 filter the -17 SR supply.

TRIAC CIRCUIT 2-53.

The triac circuit protects the 5790A if it is inadvertently plugged into an excessively high line voltage. For example, it protects the 5790A if it is plugged into a 230V line when the rear panel line voltage select switches are set for 115V operation.

This circuit contains triac CR19, zener diodes VR20, VR21, resistor R1, and capacitor C23. The zener diodes set a trip voltage of 82V. If the ac voltage across the main transformer secondary for the ±17V supply exceeds 82V, the triac fires, shorting out the winding, which causes the main transformer primary fuse to blow.

FR1 SUPPLIES 2-54.

Line FR1 COM is the return path for the unregulated +5 FR1R raw supply and the regulated +5 FR1, and -18 FR1 supplies. Each supply uses a full-wave bridge configuration.

The unregulated +5 FR1R supply consists of bridge rectifier CR15 and filter capacitor C19. The input is fused with 1.6A slow-blow fuse F8. The regulated +5 FR1 supply uses the unregulated +5 FR1R supply and contains regulator U2, filter capacitor C20, and protection diode CR16.

The -18 FR1 supply consists of bridge rectifier CR17 and filter capacitor C21. Its input is fused with 0.5A slow-blow fuse F9. The regulated -18 FR1 supply uses the unregulated -18 FR1 supply and contains regulator U3, filter capacitor C22, and protection diode CR18.

UNREGULATED FR1 SUPPLY 2-55.

FR1R COM is the return path for the unregulated +30 FR1 supply. This supply uses full-wave bridge rectifier CR14 and filter capacitor C18. Its input is fused with 0.5A slow-blow fuse F7.

FR2 SUPPLIES 2-56.

FR2 COM is the return path for unregulated +30 FR2R supply and regulated -5 FR2 supply. Each supply uses a full-wave, bridge configuration. The unregulated +30 FR2R supply consists of bridge rectifier CR7 and filter capacitor C9. Its input is fused with 0.5A slow-blow fuse F4. The -5 FR2 supply consists of bridge rectifier CR11, filter capacitor C11, regulator U1, bypass capacitor C12, and protection diode CR9. The input is fused with 315 mA slow-blow fuse F6.

Regulator/Guard Crossing Assembly (A17) 2-57.

The Regulator/Guard Crossing assembly (A17) provides two separate functions: voltage regulation for the analog power supplies and digital controller functions for the inguard. The voltage regulation portion is described first followed by the digital control portion. Refer to the schematic diagrams for the Regulator/Guard Crossing Assembly for this discussion.

VOLTAGE REGULATOR CIRCUITRY 2-58.

The regulator circuit receives unregulated dc from the regulator filter circuit on the Filter assembly (A18) and provides nine regulated dc outputs that power the analog

assemblies. Table 2-10 lists the regulated supplies from the Regulator/Guard Crossing Assembly.

REGULATED LH SUPPLIES 2-59.

The +5RLH supply used the unregulated +5LHR supply from the Filter assembly. The +5RLH supply uses three-terminal TO-3 regulator U11, bypass capacitors C20 and C70, protection diodes CR17 and CR20. Resistors R21 and R22 set the output voltage level of +5RLH. LH COM is the return path.

The +5LH supply used the unregulated +5LHR supply from the Filter assembly. The +5LH supply uses three-terminal TO-3 regulator U8 with heat sink, bypass capacitors C20 and C69, and protection diodes CR14 and CR16. LH COM is the return path.

The -5LH supply uses the unregulated -5LHR from the Filter assembly and consists of three-terminal TO-220 regulator U12, bypass capacitors C23 and C24, and protection diodes CR21 and CR24. RLH COM is the return path.

Capacitors C20, C23, C69, C70, and C24 improve the stability and provide filtering for U8, U11, and U12 respectively. Diodes CR14, CR17, and CR24 protect the regulators from input shorts. Diodes CR16, CR20, and CR21 protect the regulators from reverse voltage.

REGULATED ±17S SUPPLIES 2-60.

S COM is the return path for the +17S, and -17S supplies. S COM is also connected to LH COM. These signal lines can be found on the Motherboard and the Regulator/Guard Crossing assembly.

The +17S supply uses the unregulated +17SR supply from the Filter assembly. This supply uses three-terminal TO-3 regulator U6 with heat sink, and R5 and R6. The output voltage is set by resistors R5 and R6. Capacitors C9 and C67 are for bypass. Capacitor C11 improves ripple rejection. Diode CR8 protects the regulator against shorts at the input, while CR11 and CR26 protect the regulated output from reverse voltage.

The -17S supply uses the unregulated -17SR supply from the Filter assembly. It uses three-terminal TO-3 regulator U7 with heat sink, and R10 and R11. The output voltage

Table 2-10. Regulated Outputs from the Regulator/Guard Crossing Assembly

SIGNAL NAME	NOMINAL OUTPUT	TOLERANCE	CURRENT LIMIT	RATED OUTPUT	TEST POINT
+15 CH	+15V	±800 mV	2A	200 mA	TP3 (common TP4)
-15 CH	-15V	±800 mV	2A	200 mA	TP5 (common TP4)
+5RLH	+5.975V	±425 mV	2A	600 mA	TP14 (common TP10)
+5LH	+5.1V	±300 mV	2A	600 mA	TP11 (common TP10)
-5LH	-5V	±300 mV	2A	400 mA	TP15 (common TP10)
+17S	+17.475V	±475 mV	4A	1.0A	TP8 (common TP9)
-17S	-17.865V	±835 mV	6A	1.0A	TP12 (common TP9)
+30FR1	+30.96V	±1.7V	1A	85 mA	TP2 (common TP1)
+30FR2	+30.96V	±1.7V	1A	85 mA	TP7 (common TP6)

is set by resistors R10 and R11. Capacitors C68 and C15 are for bypass. Capacitor C14 improves ripple rejection. Diode CR15 protects the regulator against shorts at the input, while CR13 and CR27 protect the regulated output from reverse voltage.

REGULATED ±15CH SUPPLIES 2-61.

CH COM is the return path for the +15CH and -15CH supplies.

The +15CH supply uses the unregulated +15CHR supply from the Filter assembly. This supply uses three-terminal TO-220 regulator U2. Capacitors C1 and C2 are for bypass. Diode CR3 protects the regulator against shorts at the input, while CR2 protects the regulated output from reverse voltage.

The -15CH supply uses the unregulated -15CHR supply from the Filter assembly. This supply uses three-terminal TO-220 regulator U3. Capacitors C4 and C5 are for bypass. Diode CR7 protects the regulator against shorts at the input, while CR5 protects the regulated output from reverse voltage.

FR1 SUPPLY 2-62.

FR1 COM is the return path for the +30FR1 supply. This supply uses the unregulated +30FR1R supply from the Filter assembly and consists of three-terminal TO-39 regulator U1 with heat sink, bypass capacitors C3 and C6 and protection diodes CR1, CR4, and CR6. Resistors R1 and R2 set the output voltage. Capacitor C7 improves ripple rejection. Diodes CR1 and CR4 protect U1 against input shorts, while CR6 protects against reverse voltage.

FR2 SUPPLY 2-63.

FR2 COM is the return path for the +30FR2 supply. This supply uses the unregulated +30FR2R supply from the filter assembly and consists of three-terminal TO-39 regulator U5 with heat sink, bypass capacitors C10 and C28, and protection diodes CR9, CR10, and CR12. Resistors R4 and R8 set the output voltage in the same manner as the +44S supply. Capacitor C12 improves ripple rejection. Diodes CR9 and CR10 protect U5 against input shorts, while CR12 protects against reverse voltage.

GUARDED DIGITAL CONTROL CIRCUITRY 2-64.

The Inguard CPU controls all the analog assemblies. It communicates with the Unguarded CPU assembly (A20) through a serial fiber-optic link. The Inguard CPU is a Hitachi 63B03Y0 CMOS microcontroller (U56). Support circuitry includes 32K x 8 bit (32 KB) of external CMOS ERROM, 8K x 8 bit (8 KB) of external CMOS static RAM, watchdog timer circuitry, reset and power glitch detect circuitry, a serial fiber-optic link to the unguarded CPU, a DUART (dual asynchronous receiver transmitter) to provide two serial interface channels, and decoders and buffers to interface to the guarded digital bus.

Inguard CPU Memory Map 2-65.

Table 2-11 shows the memory map of the Inguard processor.

Inguard Memory Configuration 2-66.

The microcontroller (U56) has 32 KB of external EPROM program memory in IC U64. IC U62 provides 8 KB of external static CMOS RAM. Programmable Logic Device (PLD) U58 does the decoding of the microcontrollers address and status lines to select the appropriate device.

Inguard Clock Circuit 2-67.

Crystal Y52, resistors R54, R53, and R55, capacitors C61 and C62, along with inverters U51A and U51F provide the 7.3728 MHz system clock. Programmable Logic Device

Table 2-11. Inguard CPU Memory Map

ADDRESS SPACE (HEX)	NAME	USE
0000 through 0027		Internal Registers in the 6301
0028 through 003F		Unused
0040 through 013F		Internal RAM in the 6301 (256 Bytes)
0140 through 0FFF		Unused
1000 through 100F		DUART
1010 through 1FFF		Unused
2000 through 2007	CS0*	Motherboard assembly 82C55
2008 through 200F	CS1*	A/D assembly 82C55
2010 through 2017	CS2*	A/D assembly NULL DAC
2018 through 201F	CS3*	Unused
2020 through 2027	CS4*	DAC assembly 8254
2028 through 202F	CS5*	Unused
2030 through 2037	CS6*	Unused
2038 through 203F	CS7*	Unused
2040 through 2FFF		Unused
3000 through 7FFF		RAM
8000 through FFFF		ROM

(PLD) U58 divides this by two to generate the 3.6864 MHz DUART clock called DUARTCLK.

Inguard Watchdog Timer 2-68.

The watchdog timer circuit uses a 74HC4020 (U59) counter. The microcontroller (U56) generates a 19.2 kHz square wave (SCLK) on pin 11. Once the clock frequency is initialized, it runs without software supervision. This clock drives U59, which divides by 16384 to obtain a logic low interval of 427 ms followed by a logic high interval of 427 ms. The output of the U59 goes through inverter U51D to generate the NMIPOP* signal (a nonmaskable interrupt) to the microcontroller. Programmable Logic Device (PLD) U58 also gets NMIPOP* which it uses to generate POP. Circuitry on the analog assemblies use the POP signal to open all the input relays and clear other circuitry. The microcontroller must toggle pin 11 of U59 more frequently than 427 ms to prevent the watchdog timer from going off unless the watchdog is disabled by holding CLRCNTR high.

Power-Up and Reset Circuitry 2-69.

This circuit consists of U60, SW51, C55, C56, R52, and Z51. The line monitor chip (U60) detects three events: the power supply falling below 4.5V, reset being initiated by closure of momentary contact switch SW51, or BREAK being asserted from the break detection circuitry. If any of these conditions occurs, U60 resets the board for 130 ms. Pin 5 and 6 of U60 is are open-collector outputs, pulled high by Z51 and low by Z55.

Break Detection 2-70.

The break detect circuit acts as a serial communications break detector enabling the CPU assembly (A20) to reset the microcontroller (U56) via the power-up and reset circuitry. This break detect circuit uses a 74HC4020 counter (U63) and an inverter U51C. The microcontroller (U56) outputs a 19.2 kHz square wave (SCLK) on pin 11. This signal clocks U63, which in turn divides the signal by 4096 to produce successive logic low and high intervals (each of 106 ms) at the BREAK output (U63, pin 1). Under normal conditions the RCV (receive) line is high to hold U63 clear. The main 68HC000 CPU can force a reset of the Guard Crossing over the fiber-optic link by holding RCV low for more than 106 ms, which causes BREAK to go high. BREAK, inverted by U51C, is used by the reset circuitry to force a Guard Crossing reset via RESET*.

Fiber-Optic Link to CPU 2-71.

Guarded digital and analog circuits are isolated from the unguarded CPU assembly (A20) by a fiber-optic link that asynchronously transmits serial data. On the transmit side, the microcontroller transmit output (XMT) controls a 75451 (U57) which drives fiber-optic transmitter mounted on the Analog Motherboard. Receive signal RCV comes from fiber-optic receiver also mounted on the Analog Motherboard. The receiver converts the light signal to TTL levels that become the RCV signal at the microcontroller. A fiber-optic cable links the fiber-optic transmitter on the Analog Motherboard to the fiber-optic receiver on the Digital Motherboard. Another fiber-optic cable links the other receiver/transmitter pair on the motherboards.

Interface to Guarded Digital Bus 2-72.

The interface to the guarded digital bus consists of a 74HCT245 (U55), a 74HCT244 (U52), a 74HC137 (U53), resistor packs Z52, Z53, and Z54, and the POP line from U58. U52A and U52B buffer various control and address lines. Resistors from Z52 pull the lines of U52A to desired inactive states when BUSEN* is at a logic high, disabling the bus. U55 is a bi-directional data bus buffer (D0-D7). Resistor packs Z53 and Z54 match the lines of the buffered data bus, reducing reflected noise. IC U53 performs a 3-to-8 decode of address lines AB3-AB5, generating 8 select lines (CS0*-CS7*) on the guarded digital bus. These 8 signals select the various components on the Analog Motherboard. The POP signal from U58 is a reset line sent to the analog assemblies. DUART (dual asynchronous receiver transmitter) U65 provides the serial communication channel to the A/D chip on the A/D Amplifier (A15) assembly. HGRCV and HGXMT are the serial communication lines from and to the A/D chip.

Inguard CPU Interrupts 2-73.

The Inguard CPU microprocessor handles many different interrupts. These are listed in Table 2-12 in order of priority with the highest priority interrupts first.

Transfer Assembly (A10) 2-74.

Figure 2-5 is a block diagram of the A10 Transfer assembly. This assembly contains the transfer switches, 22V/220V dividers, precision ac amplifiers, FTS, and associated

Table 2-12. Inguard CPU Interrupts

VECTOR MSB	LSB	INTERRUPT	DESCRIPTION
FFFE	FFFF	RES*	Powerup and Reset
FFEE	FFEF	TRAP	Address error or opcode error
FFFC	FFFD	NMI*	Nonmaskable interrupt (Watchdog NMIPOP*)
FFFA	FFFB	SWI	Software interrupt (unused)

Table 2-12. Inguard CPU Interrupts (cont)

VECTOR MSB	LSB	INTERRUPT	DESCRIPTION
FFF8	FFF9	IRQ1*	DUART (IRQ1*)
FFF6	FFF7	ICI	Timer 1 input capture (unused)
FFF4	FFF5	OCI	Timer 1 output compare 1,2 (software timers
FFF2	FFF3	TOI	Timer 1 overflow (unused)
FFEC	FFED	CMI	Timer 2 counter match (unused)
FFEA	FFEB	IRQ2*	Input Protection Fault (IRQ2*)
FFF0	FFF1	SIO	RDRF + ORFE + TDRE + PER (internal UART)

RDRF = Receive Data Register Full
ORFE = Overrun Framing Error
TDRE = Transmit Data Register Empty
PER = Parity Error

control and support circuitry. This assembly also contains input selection relays and provides the drive signals for the Analog Motherboard relays. The 700V/1000V divider is located on the Analog Motherboard.

INPUT SIGNAL PATHS 2-75.

The 5790A has two dc to 1 MHz/700 μV to 1000V inputs, one SHUNT input and one WIDEBAND input. All of these inputs except the WIDEBAND input are routed to the Transfer assembly. (The WIDEBAND input goes to the A6 Wideband assembly.) The two dc to 1 MHz inputs are identical internally, but use different external connector types. INPUT 1 is a Type "N" coaxial connector and INPUT 2 consists of five-way binding posts.

Relays K1 through K4 on the Transfer assembly and K3 and K4 on the Analog Motherboard select the active input. These relays are wired as a 2 X 3 crosspoint switch

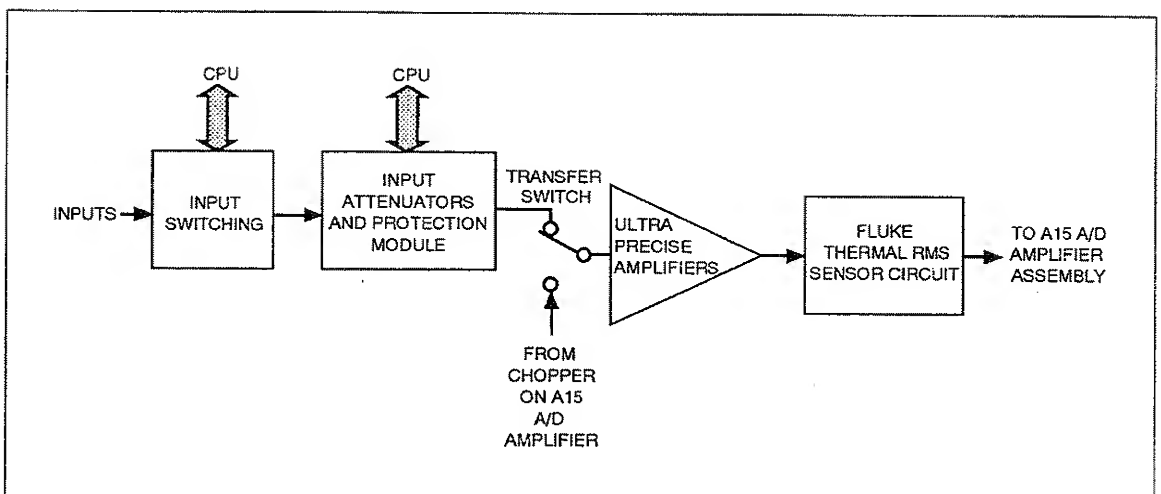

Figure 2-5. A10 Transfer Assembly Block Diagram

having 2 inputs and 3 outputs, with the input selected by the operator and the output determined by the selected range. Figure 2-6 is a simplified schematic of the input attenuator networks.

700 AND 1000V Ranges 2-76.

For input voltages greater than 220V, i.e., the 700V and 1000V ranges, the selected input (INPUT 1 or INPUT 2) is routed to the 700V/1000V divider by Analog Motherboard relays K3 (INPUT 1) or K4 (INPUT 2). A divider attenuates the input signal by a factor of 1000 and routes the signal to the Transfer assembly through connector J110. Once on the Transfer assembly, the scaled input signal is switched into the precision amplifier by IC analog switches U2 and U1. In the 700V and 1000V ranges, U2 does the transfer switching between the input signal and the internally-generated chopped dc, while U1 simply provides a continuous connection from U2 to the amplifier.

7 to 220V Ranges 2-77.

For inputs in the 7V to 220V ranges, relay K3 or K4 applies the selected input to 200V/22V divider Z1. This divider has 2 taps; a divide-by-100 for the 220V and 70V ranges, and a divide-by-10 for the 22V and 7V ranges for frequencies below 100 kHz. The divide-by-100 tap is also used for the 7V and 22V ranges above 100 kHz. Relay K6 routes the output of the divide-by-10 tap to the input amplifier via U1. This relay prevents excessive voltage from appearing at the input of U1 while in the 220V range. The divide-by-100 tap goes directly to U1. In the 7 to 220V ranges, ac/chopped dc transfers are done by alternately closing the KV and dc, and either 220V or 22V channels of U1. In these ranges, the U2 CHOP switch is always closed.

Millivolt Ranges 2-78.

For the 2.2V range and below, relays K1 and K2 select the input. The output of these relays route the input signal through the protection circuit A10A2. The protection circuit output is switched into the precision amplifiers by U1 the same way as the 220V/22V divider taps. The protection circuit protects the precision amplifiers from destructive voltages. The circuit behaves like a 1 kΩ series resistance during normal operation and quickly changes to an extremely high resistance when the voltage exceeds about 4V rms.

SHUNT Input Signal Path 2-79.

The SHUNT input is compatible with the Fluke series of A40 current shunts. These shunts, when used with the adapter shipped with the 5790A, allow you to measure relative current between 2.5 mA and 20A with a full-scale output voltage of 0.5V rms. Relay K5 switches the SHUNT signal into the terminating 90.9Ω resistor R7. The signal is then applied to the precision amplifiers through U1 and U2 in much the same way as in the 1000V and 700V ranges.

PRECISION AMPLIFIERS 2-80.

To maintain high input impedance at the 5790A INPUT terminals, an amplifier buffers input signals before they are be applied to the FTS, which has an input impedance of 400Ω. (The input impedance specification of the 5790A varies from 50 kΩ to 10 MΩ, depending on input voltage range.)

Amplifiers are also required in some ranges to boost the input signal to the appropriate level for the FTS. The optimum operating range for the FTS is between 0.7V and 2.2V (exactly a 10-dB range). Input signals below 0.7V are amplified as well as buffered. As described under the previous heading, high-voltage divider outputs are in the range from 0.22V to 2.2V.

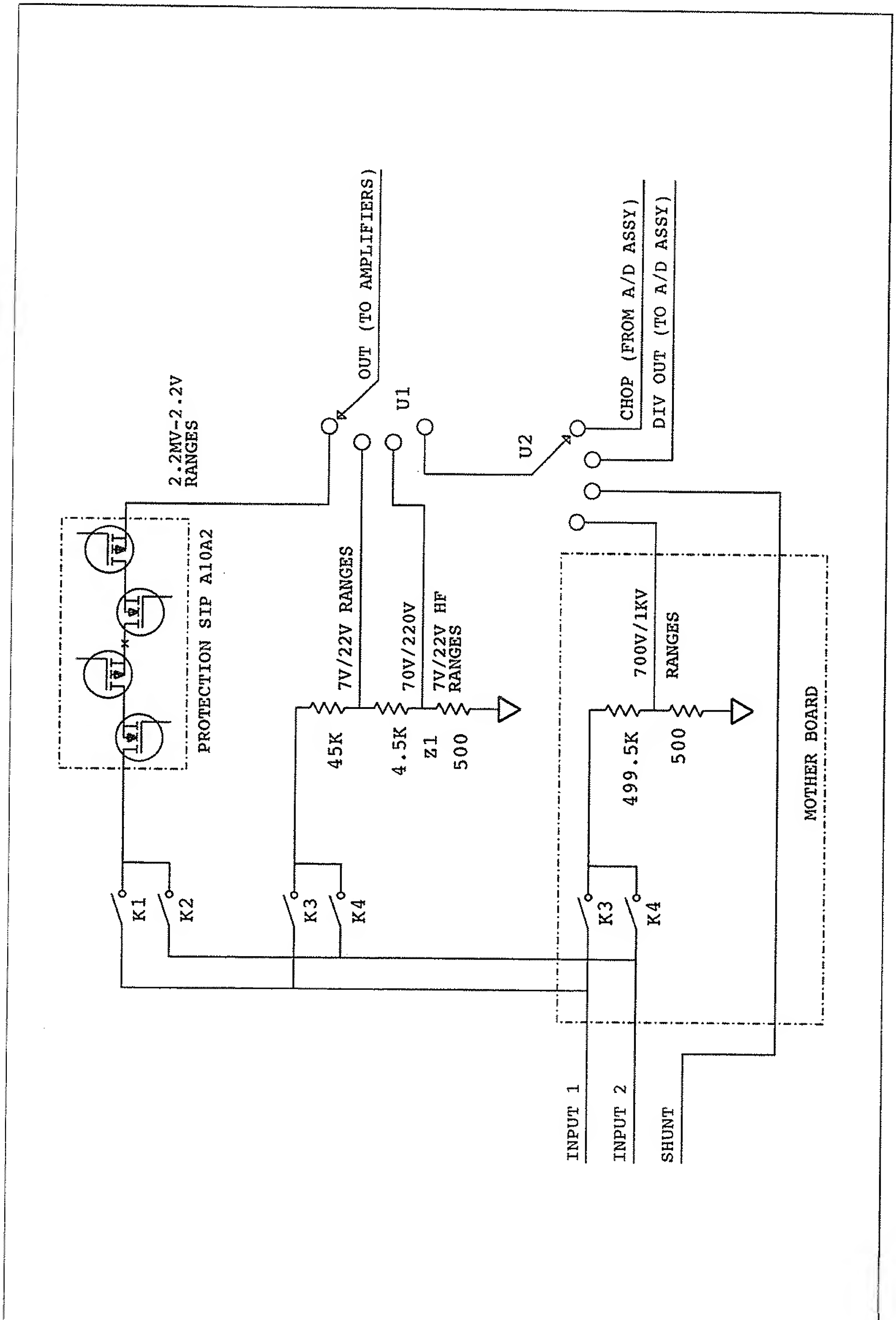

Figure 2-6. Input Divider Network Simplified Schematic

Amplifier A10A1 is a dual-gain, discrete, surface mount assembly, with 0-dB and 10-dB configurations. For the 0.22V, 2.2V, 22V, 220V, and 1000V ranges, the gate of Q3 is high and the gate of Q2 is low, configuring A10A1 as a unity-gain buffer. For all of these ranges except the 0.22V range and the 22V range above 100 kHz, the output of A10A1 falls between 0.7V and 2.2V and is connected directly to the FTS, U5, by relay K7.

For the 70 mV, 700 mV, 7V, 70V, and 700V ranges, A10A1 is configured as a 10-dB amplifier by reversing the drive signals to Q2 and Q3. In these ranges, except for the 70mV range and the 7V range above 100 kHz, the output of A10A1 is again between 0.7V and 2.2V, and likewise connected to U5 through relay K7.

For the 70 mV and 220 mV ranges, and the 7V and 22V ranges above 100 kHz, an additional gain of 20 dB is needed to bring the input signal up to the 0.7V to 2.2V range required by U5. This is accomplished by switching the output of A10A1 into the input of A10A3 with U12. A10A3 is a 20-dB, fixed-gain amplifier similar in design to A10A1. Relay K7 is toggled to disconnect A10A1 and connect the output of A10A3 to the sensor.

For inputs between 700 μV and 22 mV a different, high-gain signal path is employed. This path is switched by Q7 and Q8. For inputs in this range, the DISABLE* signal is held high, turning on Q7 and turning off Q8, allowing the AMP IN signal to be connected to U6. For voltages outside the 700 μV to 22 mV, the DISABLE* bit is driven negative, opening Q7 and closing Q8, shorting the input of U6 to ground.

A gain of 100 or 40 dB is required to meet the nominal FTS input voltage for input voltages between 7 mV and 22 mV. This is achieved by cascading U6 (gain of 10), and A10A3 (gain of 10), with U12 and K7 providing the necessary connections to the FTS, U5. The 2 mV and 7 mV ranges need an additional 20 dB and 10 dB of gain. This gain is provided by switching the output of U6 into the input of amplifier U11. U11 is configured with a gain of 10 (20 dB) and is switched into A10A3 by U12 for the 2 mV range. For the 7 mV range, the output of U11 is attenuated by 10 dB by R10 and R36, and switched into A10A3 by U12.

THERMAL SENSOR CIRCUIT 2-81.

The FTS circuit converts the ac or dc signal at its input into a dc voltage equal to the rms value of the input. The FTS consists of two identical islands suspended in air, each containing a heater resistor and an NPN transistor. Each island provides close thermal coupling between the resistor and transistor. Between islands there is high thermal isolation. As shown in the schematic, these two transistors are connected as a differential gain stage with a differential input voltage of zero volts. Applying a voltage to the resistor on one of the islands causes that island to heat up. This in turn heats the transistor, reducing its base-emitter voltage causing an imbalance in the differential collector current. This differential current change is converted to a single-ended error current by the current mirror consisting of the two PNP transistors of U101. Op-amp U102 integrates this error current, converting it to an error voltage. The output of U102 pin 1 is then passed through a square-root circuit consisting of the other half of U102 and U103. The resultant error signal is then applied to the other side of U5 through R103, heating up that side of the sensor. When the heat on both islands of the FTS is equal, the differential error current reaches zero and the circuit is in equilibrium.

An over-voltage protection circuit monitors the base-emitter voltage of the sensor transistors. As with other silicon junctions, the base-emitter junction on the FTS transistors exhibits a -2 mV/°C temperature coefficient. When the base-emitter junction falls below 200 mV, the output of U4 goes from -15V to +15V, turning on Q1. This

shorts the sensor input to ground through the diode bridge, CR7 through CR10 and allows the FTS to cool. When the temperature falls and the base-emitter voltage increases past the 200 mV threshold, U4 again changes state and turns off the clamp. During a continuous overload, the protection circuit oscillates between these two states.

To facilitate rapid autoranging, the output of U4 generates an interrupt signal for the CPU by turning on Q6. This way the CPU can react quickly to an overload at the FTS.

DIGITAL INTERFACE AND CONTROL 2-82.

An 82C55 peripheral interface IC on the Analog Motherboard latches in digital control signals. A pair of UCN5801 power drivers (U20 and U21) control relays. Three octal latches (U22 through U24) control the solid-state switches. Components U34, U36, Q5, and Q6 process the overload and protection interrupts.

A/D Amplifier Assembly (A15) 2-83.

The A15 A/D Amplifier board contains circuitry for generating the chopped dc reference for the A10 Transfer assembly and circuitry for measuring the output of the Fluke Thermal Sensor circuit, also on the Transfer assembly. The chopper circuit is described first, followed by the A/D amplifier and frequency counter.

CHOPPER CIRCUIT 2-84.

Refer to Figure 2-7 for a block diagram of the chopper circuit. The chopper circuit contains the following main circuit blocks:

- 2V divider/DC reference select
- Precision inverter
- Chopper oscillator
- Chopper switches
- Chopper attenuators

2V Divider/DC Reference Select 2-85.

Line S-COM is supplied through resistor R4 when the chopper is not in use. DAC-SNS-HI is supplied (2.2 to 7V) on the 7x10^n ranges (available at TP8). A 5:1 divider (Z6 pins 8-10) is switched in to supply 0.7 to 2.2V on the 2.2x10^n ranges (available at TP7). TP16 is at RCOM.

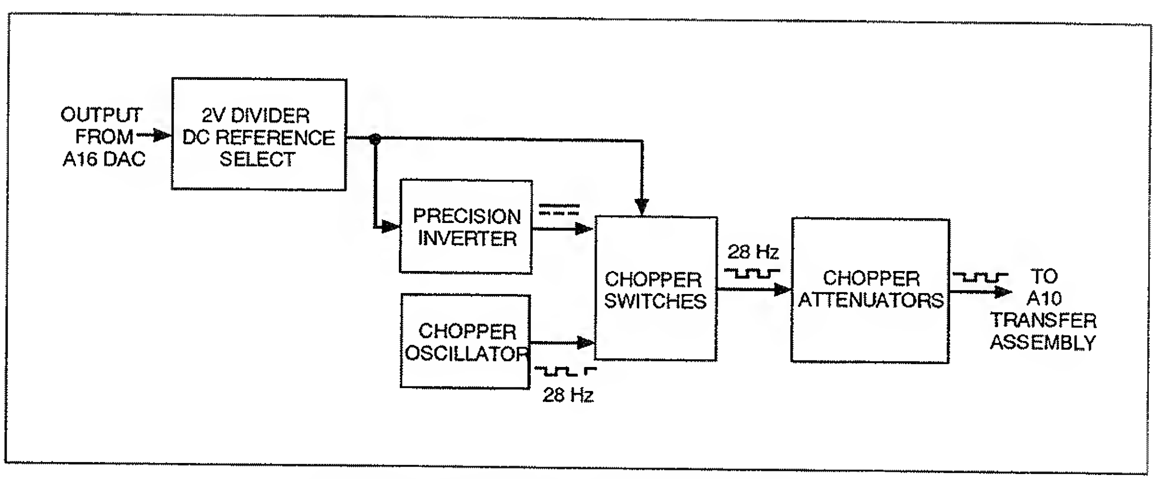

Figure 2-7. Chopper Circuit Block Diagram

Precision Inverter 2-86.

This block provides -0.7 to -7V from a 0.7 to 7V input using an LTC1043 (U9) as a switched-capacitor inverter. Capacitor C9 sets the frequency of an internal oscillator which continuously alternates the switches at about 400 Hz. Capacitor C5 is charged through R7 with a positive voltage, inverted, then discharged into C6. This provides a negative reference voltage without introducing the offset voltage of an op-amp or the temperature coefficient of a resistor network. The output of this circuit is available at TP3.

Chopper Oscillator 2-87.

This block provides a pair of square waves (50% duty cycle, 180 degrees out of phase) that clock the chopper switches. A 4047 (U8) is configured as an astable multivibrator. Resistor R2 and C4 control the 31.5 Hz rate except when wideband operation is selected, where U13 switches R15 in parallel with R2 to change the frequency to 80 Hz. Lines OSC-SET and OSC-RESET are normally low. Setting OSC-SET high stops the chopper in the inverting state. Setting OSC-RESET high stops the chopper in the non-inverting state.

Chopper Switches 2-88.

This block provides a symmetrical square wave equal in rms value to the dc input voltage (0.7 to 7V). A square wave is used instead of dc for making transfers for two main reasons:

1. The square wave passes through the ac-coupled amplifiers on the wideband board, while dc would be blocked by the coupling caps.
2. Errors caused by dc offsets which add directly to a dc reference tend to average out with a dual polarity input.

Op-amp U10 buffers the positive reference and Q3 increases current capability. Resistor R11 biases Q3 and R10 provides current limiting. IC U6 switches the output and sense alternately to a 20-dB divider (Z6) or a dummy load (R14). Similarly, components U11, Q4, R12, R13, and U7 switch the negative reference between the dummy load and divider.

Chopper Attenuator 2-89.

This block selects the output level of the chopper by switching in 20 and 40 dB attenuators. Total attenuation is:

- 0 dB for the 2.2V, 22V, 220V, and 1000V ranges (neither attenuator in)
- 20 dB for 220 mV, 700 mV, 7V, 70V, and 700V ranges
- 40 dB for 22 mV and 70 mV ranges
- 60 dB for 2.2 mV and 7 mV ranges (both attenuators in)

Relay K1 selects either 0 or 20-dB output from Z6 pin 3 or 1. Most of the current from this attenuator is cancelled by an opposite current in the dummy load, R14. The remaining current returns to CH-COM through the mecca point at TP1. IC U13 pins 1-3 or pins 14-16 select the 0 or 40-dB output from Z2 pin 1 or 3. Capacitors C10 and C11 form a 40-dB capacitive divider to reduce output impedance at high frequencies. Relay K2 routes the output to the A6 Wideband assembly for wideband operation, or to the A10 Transfer assembly for all other modes.

The following chart shows division ratio and attenuation for the various ranges:

- Input range 2.2 mV: divide by 5, 20 + 40 dB attenuators
- Input range 7 mV: no division by by 5, 20 + 40 dB attenuators
- Input range 22 mV: divide by 5, 40 dB attenuator
- Input range 70 mV: no division by by 5, 40 dB attenuators
- Input range 220 mV: divide by 5, 20 dB attenuator
- Input range 700 mV, 7V, 70V, and 700V: no division by by 5, 20 dB attenuator
- Input range 2.2V, 22V, 220V, and 1000V: divide by 5, no attenuators

A/D AMPLIFIER CIRCUITS 2-90.

Refer to Figure 2-8 for a block diagram of the A/D amplifier circuit. The A/D amplifier circuit contains the following main circuit blocks:

- Null DAC
- Instrumentation amplifier
- Switchable active low-pass filter
- A/D converter
- Frequency counter with switchable low-pass filter

Null DAC 2-91.

The Null DAC is set by the CPU to equal the A/D measurement taken with the instrumentation amplifier on the X1 setting (the first pass). This measurement shows on

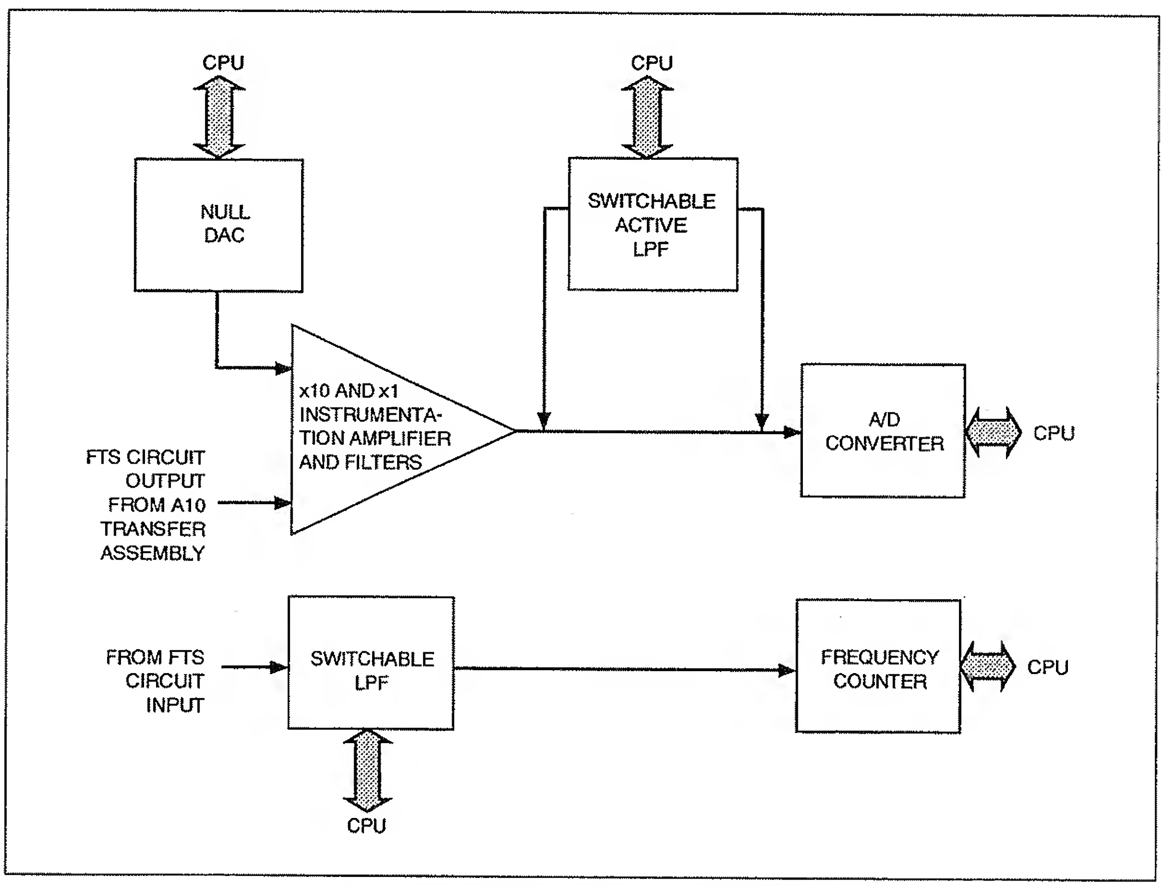

Figure 2-8. A15 A/D Amplifier Block Diagram

the display as the reading with lower resolution and the U indicator lit. This DAC has a 14-bit resolution, where 0 counts gives 0V, 3fff hex counts gives +2.2V full scale.

After the first pass, the instrumentation amp is set to X10 and the input signal is offest with the Null DAC to get higher resolution readings. The Null DAC circuit has a high degree of short-term stability, which is the critical parameter in its application.

IC U16 is an R-2R ladder DAC, using an internal feedback resistor and external op amp, U17. Since U16 is an R-2R ladder DAC, it injects a current which varies with DAC counts into the ground. IC U23 buffers R-COM to control the current from U16, preserving DAC linearity.

A 0.5 mA reference current is produced by U23 pins 5 and 6 and R18 through 20. This current biases 6.4V zener VR6. Z1 pins 1 through 3 divide down the zener voltage to provide a +1V reference for U24. U27 pins 5 through 7 and R20 and R21 form an inverting amplifier that provides a -2.5V reference for the NULL-DAC U16.

Instrumentation Amplifier 2-92.

The instrumentation amplifier amplifies the difference between the output of the Null DAC and the output of the FTS circuit on the Transfer assembly. The output of the instrumentation amplifier is fed directly into the A/D amplifier IC, U24. The result of this system is greatly improved resolution from the A/D IC. The instrumentation amplifier is switched between a unity gain and a X10 configuration.

Components U14 and U15 are used as 4-to-1 multiplexers to select the input signal to the noninverting and inverting inputs to the instrumentation amp. The noninverting input can be connected to lines RCL, DAC-SNS-HI, R-COM or NULL-DAC. The inverting input can be connected to DIV-OUT, DAC-SNS-HI, R-COM or NULL-DAC.

Components U19 and U20 buffer the inputs. Components U21, Z2 and Z3 convert the differential input signal to a single-ended output, available at TP14. (Equivalent to TP10 minus TP9.) The single-ended output is fed to the A/D IC through R27. If this voltage is too large for the A/D to read, a signal six times smaller is available through R29 and R30. Maximum resolution is obtained using U22, R24, and R25 as a X10 amplifier.

Capacitor C14 filters high frequency noise, and VR2 and VR3 clamp the output to less than the A/D ICs power rails. Components U2, R45 through 47 and C42 through 44 form a three-pole Bessel active filter to reduce noise and ripple.

Switchable Active Low-Pass Filter 2-93.

A five-pole Bessel active filter attenuates low frequency ripple. U24 pin 58 is the input to the filter and pin 56 is the output. Pin 59 and 60 connect to an internal op amp. This op amp, together with U3, C1, 2, 18, 19, 23, R23, 38, 33, 40, and 41 comprise the filter. Switches inside the A/D IC can precharge C18 and 19 quickly to reduce settling time.

A/D Converter 2-94.

A proprietary Fluke IC (U24) containing an A/D converter and frequency counter forms the basis for this circuit. Voltage is measured through pins 3, 14, 15, 16, 18, or 23. The following list describes the U24 pin functions:

- Pin 14 is the diagnostic input.
- Pin 15 is the divide-by-6 input. It measures larger voltages than the unity-gain and X10 inputs, but with the least resolution.
- Pin 18 is the unity-gain input. It measures voltages up to 3V with less resolution than the X10 input, but more resolution than the divide-by-6 input.

- Pin 23 is the X10 input. It measures voltage up to 32 mV
- Pins 28 through 35 comprise an output port that control the inputs to the instrumentation amp through U14 and U15.
- Pins 36 and 37 connect to Y1, C15, and C16 to to provide the clock for A/D timing and serial interface communication.
- Pins 39 and 40 are the serial interface, buffered by U25 pins 1 through 4.
- Pins 45 through 50, together with C17 and Z1 pins (4 through 8) form the integrator for the dual-slope A/D converter.
- Pins 51 and 52 connect to a +1V reference as described under "Null DAC."

Frequency Counter and Low-Pass Filter 2-95.

The Fluke A/D IC (U24) contains the frequency counter. Frequency is measured through pin 3. If the input signal is dc, its polarity is determined through this input.

The low-pass filter (R31 and C24) is switched in the frequency measurement line only to filter out high frequency noise. Transistor Q5 and R44 switch C41 in parallel with C24 for additional filtering for low-level input voltages at low frequencies.

DIGITAL CONTROL AND POWER SUPPLY 2-96.

An 82C55 peripheral interface IC (U26) latches in digital control signals. A UCN5801 power driver (U27) controls relays K1 and K2.

The power supply for the A/D Amplifier is comprised of the following components and circuits:

- Resistors R3 and 6 VR4 and 5 provide ±8V supplies for U9.
- Resistor R5 and VR1 provide a +5V floating supply for ICs U8 and 13. Resistor R48 and regulator VR7 supply +15V for U16.
- Capacitors C7, 8, 12, 28 through 39, 50 through 55, 62 through 64, and 67 through 70 bypass the power rails.

DAC Assembly (A16) 2-97.

The DAC (digital-to-analog converter) provides a digitally adjustable precision dc voltage from 0 to 11V. The DAC contains four assemblies:

- DAC Main Board (A16)
- DAC Filter SIP (A16A1)
- Reference Hybrid (4HR9)
- DC Amplifier Hybrid (4HR6).

The DAC uses a pulse-width-modulated scheme to vary its output. The main DAC circuits that work together for a stable and linear dc voltage are:

- A 13V temperature-controlled reference hybrid (4HR9)
- Duty-cycle control circuitry
- A five-pole active filter (A16A1 assembly)
- An output stage

Among the support circuits are:

- A sense-cancellation circuit
- Linearity control circuits
- Negative offset circuit

All these circuit blocks are shown in Figure 2-9, the block diagram of the DAC assembly.

The two inputs of the five-pole filter are two precision square waves with different fixed amplitudes and independently variable duty cycles controlled by software. The filter's first input square wave is called the first channel. It is switched between the reference voltage (13V) and 0V.

The filter's second input square wave is called the second channel. It is switched between approximately 0.78 mV and 0V. Its amplitude is derived by resistively dividing the 13V reference. This second channel is used for extra resolution.

The filter rejects all ac components of the waveforms above 30 Hz. Since the frequency of the square waves is 190 Hz, the output of the filter is a dc voltage which is the sum of average voltages of the two waveforms. The Output Stage, which consists of the dc amplifier hybrid and the output buffer, isolates the filter output from the DAC output and gives current drive to the DAC output.

To change the DAC voltage, the average value of the two square waves must be varied. To determine the average value, multiply the waveforms amplitude by its duty cycle. Vary the duty cycle and keep the amplitude fixed to change the DAC voltage.

For example, if the duty cycle of the first channel is 10% and the second channel 50%, the overall average voltage would be:

$(0.1 \times 13V) + (0.5 \times 0.78\ mV) = 1.300390V.$

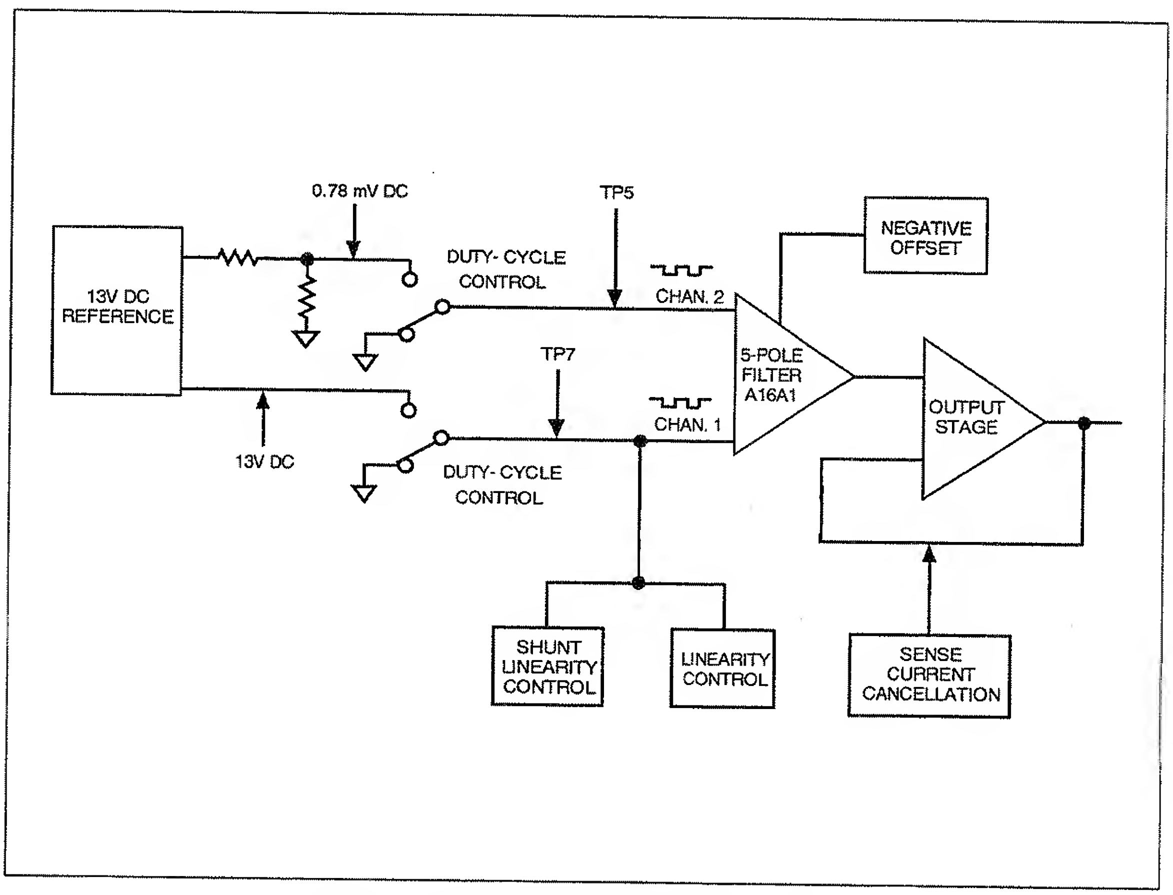

Figure 2-9. A16 DAC Assembly Block Diagram

The duty cycle resolution is 0.0024%, which gives a first channel resolution of 0.309 mV and second channel resolution of 18.5 nV.

The duty cycle control circuitry creates the two digital square waves for the first and second channels. These two waveforms are first run through optocouplers for isolation and then into analog switching and level shifting circuits. These circuits derive the proper signals to switch the input of the filter at the levels explained above.

DAC ASSEMBLY REFERENCE CIRCUITRY 2-98.

As previously explained, the amplitudes of the pulse width modulated signals for the first and second channel are assumed to be fixed. Any change in amplitude shows up as an error on the output of the DAC. The dc reference circuitry is very stable and generate little noise.

The dc reference circuitry is on the reference hybrid, located on the 4HR9 assembly. The 4HR9 assembly contains a ceramic substrate reference hybrid bonded to a resistor network.

All components on this assembly are surface mount devices, except U6 and U7. The resistors are screened with a thick film paste. Associated resistors, capacitors, and zener diodes are mounted on the main board to supply this hybrid with operating power and ground returns.

The 13V reference contains two cascaded 6.5V temperature compensated transistor/zener diode pairs called ref amps (U6 and U7). The excellent temperature characteristics of the ref amps are obtained by biasing the collector current of their transistors with a value such that the TC (temperature coefficient) of its base-emitter junction cancels the TC of the zener diode. Since the base-emitter junction and the zener diode are in series, the result is a near zero TC. Correct bias currents are achieved with a thin-film resistor network in a surface-mount package mounted on the hybrid.

The reference circuit is designed such that the effects of the thin-film resistors and op amp errors are second order. Thus, accuracy is determined almost entirely by the ref amps.

To further reduce the effects of ambient temperature variations, the hybrid is heated to a constant 62°C by the heater control circuitry on sheet 1 of the DAC schematic.

Temperature is sensed near the ref amps by a thermistor (RT1). If the substrate temperature changes, the thermistor resistance changes. This creates a correction voltage to the base of Q2 (on the main board). This, in turn, changes the power into the heater resistor screened on the back of the substrate as necessary to maintain a stable temperature.

Thermal runaway is prevented by a protection circuit. Once the substrate temperature reaches approximately 67°C, the change in resistance of RT2 causes Q9 to turn on. As transistor Q9 turns on, it steals base current from Q1 on the main board, which brings it out of saturation. This breaks the current path through the heater resistor. This condition exists only if there is a failure.

DUTY-CYCLE CONTROL CIRCUIT 2-99.

Refer to sheet 3 of the DAC schematic for the cycle control circuitry. DAC output voltages are represented in software by what are called first and second channel counts. Each count is a 16-bit number which is sent to the DAC assembly via the guarded digital bus.

For example, a first channel count of 20,000 (in decimal) represents a DAC output voltage of approximately 6.5V (half the reference voltage).

The first function of the duty-cycle control circuitry is to convert each count into a stable TTL level square wave with a duty cycle proportional to the numeric value of the count. The 82C54 programmable interval timer (U6) and 8 MHz clock (U7) generate this signal.

The 82C54 programmable interval timer receives its input counts from the guarded digital bus and creates the second channel signal on OUT2 (pin 20) and the first channel signal on OUT1 (pin 16).

The second channel signal is buffered by U8 (D and E) and runs through opto-isolator U12 to become CH2 FLOATING. This signal alternately turns FETs Q30 and Q32 on and off to turn the 3V source (called 3V) into a floating 3V pulse width modulated waveform called CH2 FILTER INPUT.

The 3V source is created from the 13V reference. The 13V reference is buffered by op amp U1B, configured as a voltage follower. The output from U1B is divided down to 3V by a 100 kΩ and 30 kΩ resistor in the 4HR9 assembly, creating 3V.

This 3V is again buffered by op amp U11, configured as a voltage follower, to create the 3V, which is switched by FETs Q30 and Q32. CH2 FILTER INPUT uses three resistors on the 4HR9 assembly to resistively divide its 3V amplitude by an additional factor of approximately 3800.

The first channel signal is buffered by U8 (G and H) and run through opto-isolator U13, to become CH1 FLOATING. Since the first channel is much more critical than the second, CH1 FLOATING is clocked into a flip-flop (U14) to ensure an accurate waveform.

To clock in this waveform, U7 generates the clock inputs for U14. The output Q1 (pin 5) from U14 creates CH1 SERIES A, which switches Q7. The output Q1* (pin 6) is inverted by Q35, creating CH1 SHUNT, which switches Q6. The output Q1*, which is a TTL level, is also amplified by components Q33, Q34, VR11, VR12, and R44-R46, so it switches from 0 to 18V, creating CH1 SERIES B, which switches Q4 and Q5.

DAC FILTER CIRCUIT 2-100.

The dac filter circuit is located on the DAC Filter SIP assembly. The dominant pole of the five-pole Bessel filter is near 30 Hz. This gives 80 dB of rejection at 190 Hz.

DAC OUTPUT STAGE 2-101.

The output stage of the DAC assembly consists of the DC Amplifier Hybrid assembly (4HR6) and the output buffer circuitry. Like the Reference Hybrid, the DC Amplifier Hybrid is constructed of surface-mount components (except precision op amp U2), on a ceramic substrate hybrid, bonded to a resistor network. This hybrid is temperature-controlled by a heater control circuit in the same manner as explained on the Reference Hybrid. Transistor Q3 supplies appropriate power to the heater resistor.

The DC Amplifier Hybrid consists of a precision op amp U2, with a bootstrapped power supply (Q1, Q2, R1 through R4, and VR1 through VR2). The op amp has low noise and low offset. It is bootstrapped to improve the common-mode rejection in its noninverting configuration.

The DC Amplifier assembly interfaces with the output buffer (U5) to create the output stage. The output buffer provides drive for the DAC output. It is used in a feedback loop

with the DC Amplifier Hybrid so that the dc accuracy is dependent upon the dc amplifier, and the output drive capability is dependent on the output buffer.

SENSE CURRENT CANCELLATION CIRCUIT 2-102.

This circuit supplies the sense current of equal, but opposite, polarity to the current in the feedback resistors. This eliminates current in the sense connection DAC SNS HI. Components U1A and four resistors on the 4HR6 assembly do this task.

LINEARITY CONTROL CIRCUIT 2-103.

The linearity control circuitry contains the series linearity control circuit and the shunt linearity control circuit, as labeled on the schematic. These linearity control circuits eliminate filter current in the series switch (Q5) and the shunt switch (Q6). This is necessary because Q5 and Q6 have finite resistance (3 to 5Ω) and a small mismatch in the resistances can cause a linearity error.

The series linearity control circuit uses op amp U38, resistor network Z2, and a single 15.710 kΩ resistor on the 4HR9 assembly. This circuit eliminates filter current in the series switch Q5.

When the series switch (FET Q5) is on, it connects the 13V reference to the first channel input of the filter, and FET Q4 is also turned on. This causes U38 to supply the current to the filter through the 15.710 kΩ resistor in 4HR9 and Q4, which makes the resistance from TP2 to TP5 look like near 0 ohms.

The shunt linearity control circuit uses op amp U2B, FET Q22, two 80 kΩ resistors on the 4HR6 assembly, and one resistor in the 4HR9 assembly. Op amp U2B is configured as an amplifier with an inverting gain of 1. This gain is determined by the two 80 kΩ resistors in the 4HR6 assembly.

When the shunt switch (FET Q6) is on, connecting the input of the filter to REFCOM, the current from the filter flows through the two 40 kΩ resistor (pin 7 to pin 8) on the 4HR6 assembly to the output of U2B. This cancels out the current that would flow through Q6 which makes it look like 0Ω.

NEGATIVE OFFSET CIRCUIT 2-104.

This circuit creates a constant offset voltage of approximately -127 mV at the filter input. Thus, for a DAC output voltage of 0V, the first channel count must be approximately 400 to offset this negative voltage. This guarantees a minimum duty cycle pulse width of approximately 50 µs.

This minimum duty cycle is necessary to overcome the offset of the output stage and to allow the reference voltage to settle out after being switched into the filter input. Op amp U2A and two 20 kΩ resistors in 4HR6 form an amplifier with an inverting gain of 1. This amplifier input is the 13V reference which produces -13V at its output. This -13V is divided by resistors in the 4HR9 assembly to create the -127 mV on the filter input.

Wideband Module (A6, Option -03) 2-105.

The 5790A Wideband option extends the 5790A operating range to accept signals from 600 µV to 7V over a frequency range of 10 Hz to 30 MHz. The input impedance at the front panel WIDEBAND Type "N" connector is 50Ω on all ranges. Essentially, the Wideband assembly takes over the function of the A10 Transfer assembly when the 5790A is in the Wideband mode. Refer to Figure 2-10 and the Wideband Assembly schematic diagram for the remaining theory discussion.

Wideband inputs are made to the WIDEBAND 50Ω Type "N" connector on the front panel, and the option is activated by pressing the [WBND] key. In Wideband mode, eight input ranges are available: 2.2 mV, 7 mV, 22 mV, 70 mV, 220 mV, 700 mV, 2.2V, and 7V. The operator selects ranges the same way as in standard operation. Once the system has settled in the proper range, the displays show the amplitude and the frequency of the input.

The front panel WIDEBAND connector is connected by a cable to the Wideband (A6) assembly through board input connector J1. If the input exceeds approximately 14V pk, the A6A2 Input Protection module clears relay driver U26, thereby dropping out all four input relays, protecting the circuit from damage. If the input is greater than full scale on the highest range (7V), but less than the 14V trip point of the Input Protection module, the Range Comparators detect an overrange condition. Digital control of Wideband circuit then clears relay driver U26, dropping out the input relays to open the input path.

NOTE

A detailed circuit description of the A6A2 Input Protection module is provided further on.

INPUT SIGNAL PATH FOR THE UPPER FOUR RANGES 2-106.

The following text describes the input signal path from the front panel to the input of rms sensor buffer amplifier U5 as shown on the block diagram. Input signals on the upper four Wideband ranges (7V, 2.2V, 700 mV, and 220 mV) pass through relays K1 and K4 to resistor network Z1, which provides a 50Ω load. The input signal is also sensed by the A6A2 Input Protection module through diodes CR1 and CR31 for positive voltages and through CR5 and CR30 for negative voltages.

Resistor network Z1 attenuates the upper four ranges 10 dB and passes the signal to relays K7, K2, K3, K8 and attenuator Z2, which has switchable 10-dB and 20-dB sections. The relays configure attenuator Z2 for the upper four ranges as necessary to produce a 70 mV full-scale input to buffer amplifier U5. The relays configure Z2 as follows:

- 7V range: With 7V input K7, K2, K3, K8 are reset, which switches in both 10 dB and 20 dB sections of Z2 into the path, providing 30 dB of attenuation. With a 7V input to 10-dB attenuator Z1, the output of Z2 is therefor at 70 mV.
- 2.2V range: Relays K7 and K2 bypass the 10-dB section of Z2. A 2.2V input results in a 70 mV RMS signal at the RMS sensor amplifier input (Q6 and U5), which is the same full scale value as in the 7V range.
- 700 mV range: Relays K7 and K2 switch in the 10-dB section of Z2 and relays K3 and K8 bypass the 20-dB section of Z2. A full-scale input of 700 mV gives 70 mV full scale at the RMS sensor amplifier input (Q6 and U5).
- 220 mV range: Relays K7, K2, K3, and K8 bypass both 10-dB and 20-dB sections of Z2 to give 70 mV full scale at the RMS sensor input.

The 70 mV output of Z2 is connected by FET Q15 to the input of the RMS sensor amplifier Q6 and U5. When the 80-Hz chopped reference (WB CHOP) is needed in the signal path, Q15 opens the input signal path and Q16 switches in WB CHOP).

INPUT SIGNAL PATH FOR THE LOWER FOUR RANGES 2-107.

The 70 mV, 22 mV, 7 mV, and 2.2 mV ranges follow a different path to sensor buffer amplifier U5 as shown in the block diagram. Relays K1 and K4 are deactivated and

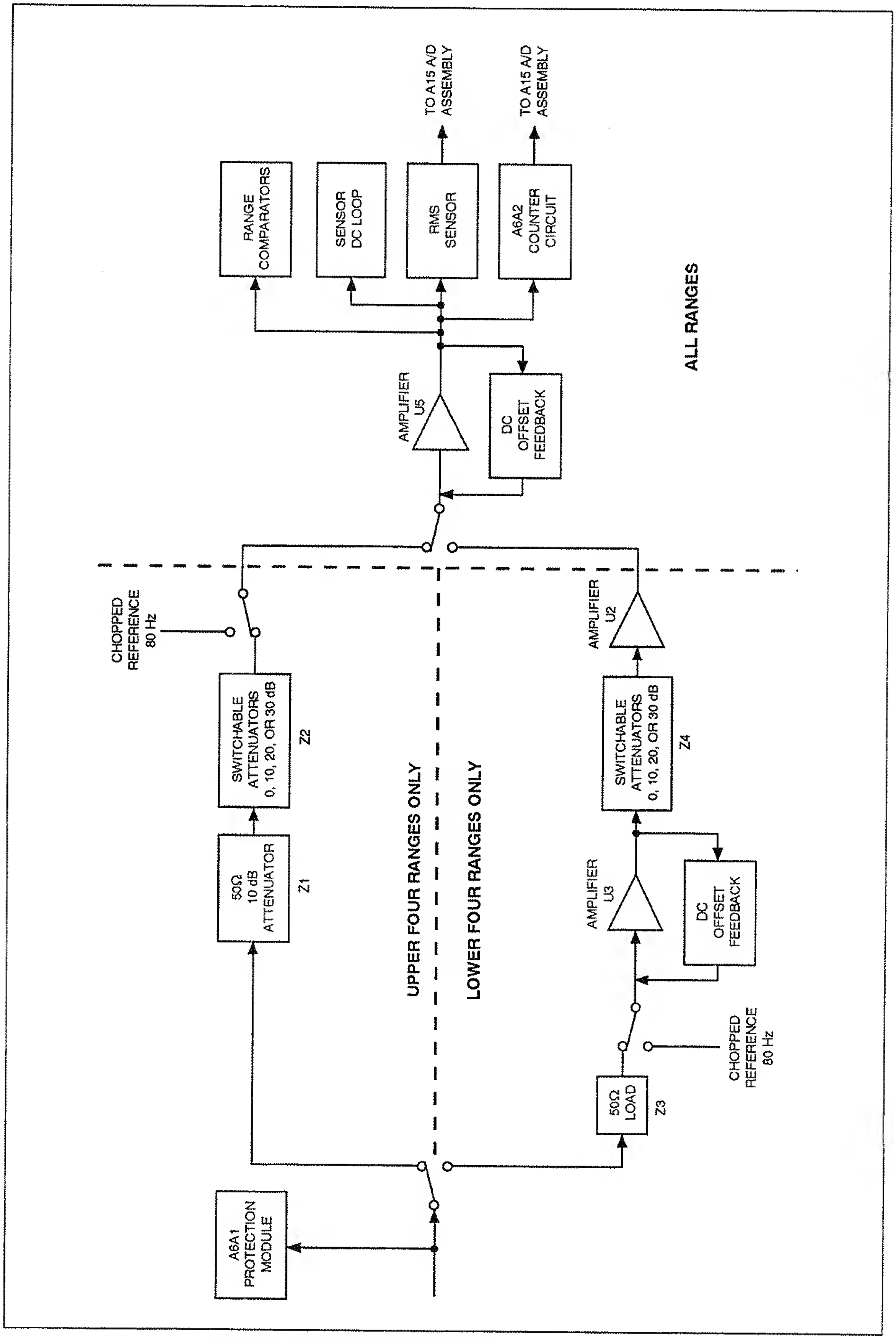

Figure 2-10. A6 Wideband Assembly Block Diagram

relays K9 and K10 are activated. A 50Ω load is provided by Z3 and the signal passes through FET Q13 to an amplifier/attenuator network composed of 25 dB amplifier Q3 and U3, 10 to 30 dB attenuator Z4 (with relays K5 and K6), 17 dB amplifier U2, and then through FET switch Q17 to the RMS sensor amplifier (Q6 and U5).

When the 80-Hz chopped reference (WB CHOP) is needed in the signal path, Q13 opens the input signal path and Q14 switches in WB CHOP). FET switches for the upper four ranges, Q15 and Q16, are always turned off in the lower four ranges.]

The lower four ranges are input signal paths are configured as follows:

- 70 mV range: The signal is connected to 25-dB amplifier U3 through FET Q13 and amplified to 1.2V. Resistor R29 (50Ω) and load Z4 (50Ω) drop the signal 6 dB to 600 mV at K5. Relays K5 and K6 are reset, which passes the signal through both the 10 dB and 20 dB sections of resistor network Z4, to give a signal level at the input of the 17 dB amplifier U2 (pin 3) of 19 mV. Amplifier U2 raises the signal level to 140 mV. Resistor divider R35 and R25 reduce the signal by 6 dB to 70 mV and the signal passes to the RMS sensor amplifier input (Q6 and U5) through FET Q17.
- 22 mV, 7 mV, and 2.2 mV ranges: These are obtained by switching out the attenuator sections of resistor network Z4 in 10-dB steps down to zero attenuation in the 2.2 mV range.

DC OFFSET FEEDBACK FOR AMPLIFIER U3 (LOWER RANGES) 2-108.

Amplifier U10 and associated parts provide a dc feedback loop to keep the dc voltage at the output of amplifier U3 (pin 6) near zero. The dc is sensed by resistor R68, amplified by U10 and feedback to FET pair Q3 at pin 6. The loop adjusts the voltage at Q3 pin 6 until the amplifier output dc voltage is near zero.

The transistors Q19, Q20, Q21, and Q22 in the sources of the dual FETS Q3 and Q6 are used to set the bias current to approximately 10 mA in each transistor and provide temperature compensation for the transconductance of the FETS. As the temperature increases, the base-emitter voltage of the transistors decreases and the current increases to keep the voltage between the base and the -6V supply constant. The increased current compensates for the decrease in the FET transconductance as the temperature increases.

RMS SENSOR CIRCUIT 2-109.

Buffer amplifier U5 amplifies the scaled inputs to 1.2V rms and passes the signal through the protection diode bridge (CR16 through CR19), and to rms sensor U15 ac input (pin 10). The A6A1 module forces a dc voltage into the dc input of rms sensor U15 pin 6 to balance the heating effect of the ac input. As in the A10 Transfer assembly, with the rms sensor balanced, the dc input to the sensor is equal to the rms of the ac input.

TRANSFER METHODOLOGY 2-110.

The dc output from the rms sensor is connected to the RCL line at P106 pins 12A and 12C by FET switch U16 (pins 3 to 2) and measured by the A15 A/D Amplifier assembly. System software takes the A/D measurement and programs the 80-Hz square wave signal (WB CHOP) from the A/D amplifier whose rms value is approximately equal to the signal input at the rms sensor amplifier input Q6.

System software switches the WB CHOP signal into either the upper-four-range or the lower-four-range signal path as previously described. The WB CHOP signal is then adjusted, if necessary, to give the same dc output of the RMS sensor U15 as the input is

alternated between the input signal and the WB CHOP signal at a 1-Hz rate. After applying appropriate constants determined when the 5790A was calibrated, the rms value of the input is displayed on the front panel.

DC OFFSET FEEDBACK FOR THE RMS SENSOR AMPLIFIER 2-111.

Amplifier U12 and associated parts provide a dc feedback loop to keep the dc voltage on rms sensor U15 AC input (pin 10) near zero. The dc is sensed by resistor R86, amplified by U12, and fed back to input FET pair Q6 at pin 6. The loop adjusts the voltage at Q6 pin 6 until the sensor dc voltage is approximately zero.

RANGE COMPARATOR 2-112.

Comparator U11 and U13, and associated parts form a circuit that indicates when the rms sensor circuit is being driven beyond normal limits. Each of the 4 Schottky diodes CR16 through CR19 is biased by current sources Q7 and Q8 to 6 mA each. When amplifier U5 is forced by large input signals to drive more than +6 mA output, diode CR16 and CR19 stop conducting. The 12 mA from Q7 flows through CR17 and split between the sensor input at U15 pin 10, and R126. The sensor receives 7.6 mA which gives +3V across the 400Ω input of rms sensor U15 pin 10. The 3V is a safe level for the sensor.

When amplifier U5 is forced to drive more than -6 mA output, diodes CR18 and CR17 stop conducting and the 12 mA from Q8 is split between the resistors and sensor input. The sensor voltage is thereby clamped at ±3V. When the diodes stop conducting in either direction, the voltage at U5 pin 6 output jumps to the saturated level of ±5V.

When the output of amplifier U5 reaches ±2.5V comparator U11 pin 4 or pin 9 drops low (pin 4 for +2.5V and pin 9 for - 2.5V) and pulls the voltage of capacitor C63 down to the trip level of 1.5V at the input of U13 (pin 3). The output of U13 at pin 1 drops low and indicates the need to change to the next highest range. At this signal, the signal at TP9 (RANGE COMP) causes gate U27 pin 11 to go high and turn on FET Q11. With Q11 on, the interrupt line at P206 pin 1A is low, thereby telling the digital system to range up.

If the up-ranging mechanism reaches the 7V range and U13 pin 1 does not indicate that the sensor amplifier is within the normal range, an overload condition exists and Wideband mode is turned off.

Diodes CR20, CR21, Q9, Q10 and associated components form a backup clamp for the rms sensor and are activated only if the CR16 through CR19 protection bridge fails. It clamps the sensor ac input pin 10 to ±3.25V.

WIDEBAND FREQUENCY COUNTER 2-113.

A circuit on the A6A1 assembly conditions signals for use by the frequency counter circuit on the A15 A/D Amplifier assembly. The counter function for Wideband mode is provided by buffer Q23 and the counter section of the A6A1 assembly. The output of rms sensor buffer amplifier U5 is connected to emitter follower Q23 through resistor R143. Q23 isloates the counter circuit from the signal measurement path. The output of Q23 is attenuated by R106 and R141 and passed to the A6A1 assembly input at pin 14 of the SIP connector. The input is sent to comparator U1 at pin 2. Comparator U1 produces an output of 3.4V (HIGH) or 0.3V (LOW) whenever the input exceeds the input threshold of about ±30 mV. The output of comparator U1 is therefore at normal logic levels and can be used by divider U2 to divide down by 16.

For frequencies greater than 1.99999 MHz, the output from the circuit is taken from the divider U2 when quad switch U3 closes the switch from pins 3 to 2 and connects the

signal to output resistor R11. When quad switch U3 closes the switch from pins 14 to 15 the output is sent on the COUNTER line across the Motherboard to the frequency counter circuit of A15 A/D Amplifier assembly, where the frequency is measured for display on the Measurement Display.

For frequencies below 2 MHz, the output from the circuit is taken from comparator U1 when quad switch U3 closes the switch from pins 10 to 11 and passes the signal to R11 and out the COUNTER line as before. Resistors R6, R10, and resistor networks Z2 and Z3 set the bias and signal levels needed on the COUNTER output line. The signal level on the COUNTER output line is ±400 mV. Below 2 MHz, additional filtering of the input signal is provided by capacitor C14 which is switched into the circuit by PIN diode CR1. CR1 is turned on by Q2 when Q1 is turned off by the digital control signal FILT. The frequency on the COUNTER line is equal to the input frequency between 10 Hz and 1.99999 MHz, and divided by 16 from 2 MHz to 30 MHz (resulting in 125 KHz to 1.875 MHz).

DIGITAL CONTROL 2-114.

Digital control of the Wideband assembly comes from the instrument digital bus and is stored in latches on the Wideband assembly. Relays K2, K7, K3, and K8 are controlled by driver/latch U25 when data is strobed in by bus line PB6. Relays K1, K4, K5, and K6 are controlled by driver/latch U26 with strobe PB7. FETs are controlled by latch U20 and strobe PC1. Switches are controlled by U21 and strobe PC2.

A6A2 INPUT PROTECTION MODULE 2-115.

The A6A2 Input Protection assembly drops out the Wideband input relays the input signal reaches approximately ±14V in amplitude. Opening the input relays protects Wideband circuits from damage. The instrument drops out of Wideband mode and activates the INPUT 2 binding posts whenever the A6A2 circuit trips.

The A6A2 circuit is composed of dual comparator U1, transistors Q1 and Q2, zener diodes VR1 and VR2, and associated components. Zener diode VR1 biases the positive input at pin 1 to +12V. Transistor Q1 is off until the Wideband input signal reaches about +14V, which causes diodes CR1 and CR31, or CR24 and CR25 on the Wideband board to start conducting. When Q1 conducts about 5 mA, it turns on and starts to raise the voltage at comparator U1 pin 5. The other input of the comparator at U1 pin 4 is biased to +0.5V. When the input at U1 pin 5 exceeds +0.5V, the comparator output turns on and drops the voltage on the output connector pin 11 to 0V. Zener diode VR2 biases the negative input at pin 3 to -12V. Transistor Q2 is off until the Wideband input signal reaches about -14V, which causes diodes CR5 and CR30, or CR14 and CR15 on the Wideband board to start conducting.

When Q2 conducts about 5 mA, it turns on and starts to lower the voltage at comparator U1 pin 9. The other input of the comparator at U1 pin 10 is biased to -0.5V. When the input at U1 pin 9 drops below -0.5V the comparator output turns on and drops the voltage on the output connector pin 11 to 0V, just as with the positive signal.

The comparator output signal at pin 11 passes to the Wideband board as the INP PROT signal and connects to a latch composed of two sections of gate package U27. Normal operation of the latch has INP PROT high and RESET high with the output at U27 pin 6 low. The output at U27 pin 3 is high, which gives a stable latch condition. U27 pin 6 is also the CLR line which connects to relay driver U26 at pin 1. The output of U27 pin 8 is high. When INP PROT drops low, the output of the latch at U27 pin 6 and CLR goes high. The high CLR signal turns off all outputs on the U26 relay driver and thereby drops out all of the input relays K1, K4, K9, and K10. With U26 pin 15 now high, the output to PC4 digital line at connector P206 pin 10C is also high. The output of U27 pin

8 goes low and cause U27 pin 11 to go high and turn on FET Q11. Q11 pulls the INT line low at connector P206 pin 1A.

The digital system recognizes that the WIDEBAND input was over ±14V when the INT line goes low at he same time that the level at PC4 (connector P206 pin 10C) went high. The system is returned to normal operation when the RESET line programmed from latch U21 pin 19 is momentarily set low to reset the U27 latch. Also PC4 is programed low by U26 pin 15 and the circuit is back to normal operation.

Section 3
Calibration and Verification

CONTENTS

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CONTENTS

INTRODUCTION 3-1.

This section gives procedures for calibrating and verifying a normally operating 5790A. In case of malfunction, refer to Section 5.

This section defines the 5790A calibration methods, then presents step-by-step procedures for calibrating the main input. You can apply calibration voltages to either INPUT 1 or INPUT 2. Calibration is valid for both inputs after calibration is complete. Following main input calibration is the procedure to calibrate the WIDEBAND input (only if the Option 5790A-03 Wideband AC module is installed).

Verification is a procedure you can use to determine calibration status (in or out of tolerance) on recall. Procedures for verifying the main input and Wideband option are presented separately.

Calibration Cycle 3-2.

Calibration is required as often as specified by your selected calibration cycle. You choose a 90 DAY, 1 YEAR, or 2 YEAR calibration cycle in a setup menu as described in Section 4, or using remote commands as described in Sections 5 and 6. The calibration procedure is the same for all calibration intervals. Your calibration cycle selection determines which set of specifications from Section 1 is valid. It is also used for Cal Shift Reports, and for display when you press the [SPEC] key.

Periodic and Service Calibration 3-3.

Periodic calibration is what you perform at the end of each calibration cycle and is all that is required to keep a normally functioning 5790A operating within specifications. For this procedure you set the rear panel CALIBRATION MODE switch to PERIODIC.

Service calibration is a more complex calibration procedure that is required only after hardware repair or replacement. Service calibration is similar to the procedure done at the factory when the 5790A is built. For this procedure set the rear panel CALIBRATION MODE switch to SERVICE. This switch setting adds many calibration points to the software-controlled calibration routine. The CALIBRATION MODE switch setting has no effect on WIDEBAND input option calibration or verification.

Full or Range Calibration 3-4.

When you perform a periodic calibration of the main input, you calibrate the dc measurement function first because subsequent ac calibration relies on 5790A dc measurement accuracy. Calibrating both the dc and ac functions is called full calibration.

Instead of full calibration, you can select range calibration, which presents display prompts for calibrating the dc or ac functions of a single input range. This allows you you to repeat portions of a just-completed calibration. You can use the "Skip Step" softkey to redo one or a few points, leaving the rest of the calibration points unchanged. Once you press a range cal softkey, you proceed with calibration steps exactly as explained under "Calibrating the Main Input" or "Calibrating the WIDEBAND Input" heading.

Automating Calibration and Verification 3-5.

Fluke uses an automated calibration and verification system to accomplish the procedures described here. To minimize time you spend on repetitive measurements and calculations, you may want to automate the following procedures to the greatest extent

possible. Sections 5 and 6 of the User Manual document the remote interfaces and commands that can help you with calibration.

NOTE

A technical paper describes the system in use at Fluke to calibrate and verify the 5790A: Calibration and Traceability of a Fully Automatic AC Measurement Standard, by David Deaver, presented in the NCSL Workshop and Symposium, 1991. Reprints are available from Fluke.

How Calibration Memory is Organized 3-6.

Three sets of calibration constants are maintained in memory. Associated with each set of constants is the date and ambient temperature of calibration. Figure 3-1 shows the three sets and how they are purged following a calibration store operation. The three sets of constants are described below, from newest to oldest:

1. The "active" set. This is a volatile memory that normally contains a copy of the contents of the stored set of calibration constants. The only time it contains different data is after you perform calibration of one or more ranges, but before you store the updated constants. After calibration, you must either store or discard the updated constants before you resume normal operation.
2. The "stored" set. At each power up, the contents of this nonvolatile memory is copied into the active set memory. Therefore, the stored set is identical to the active set until you perform a new calibration.
3. The "old" set. Although it is no longer in use, the previous set of calibration constants is saved in nonvolatile memory. This set is kept in order to make comparisons in Cal Shift reports.

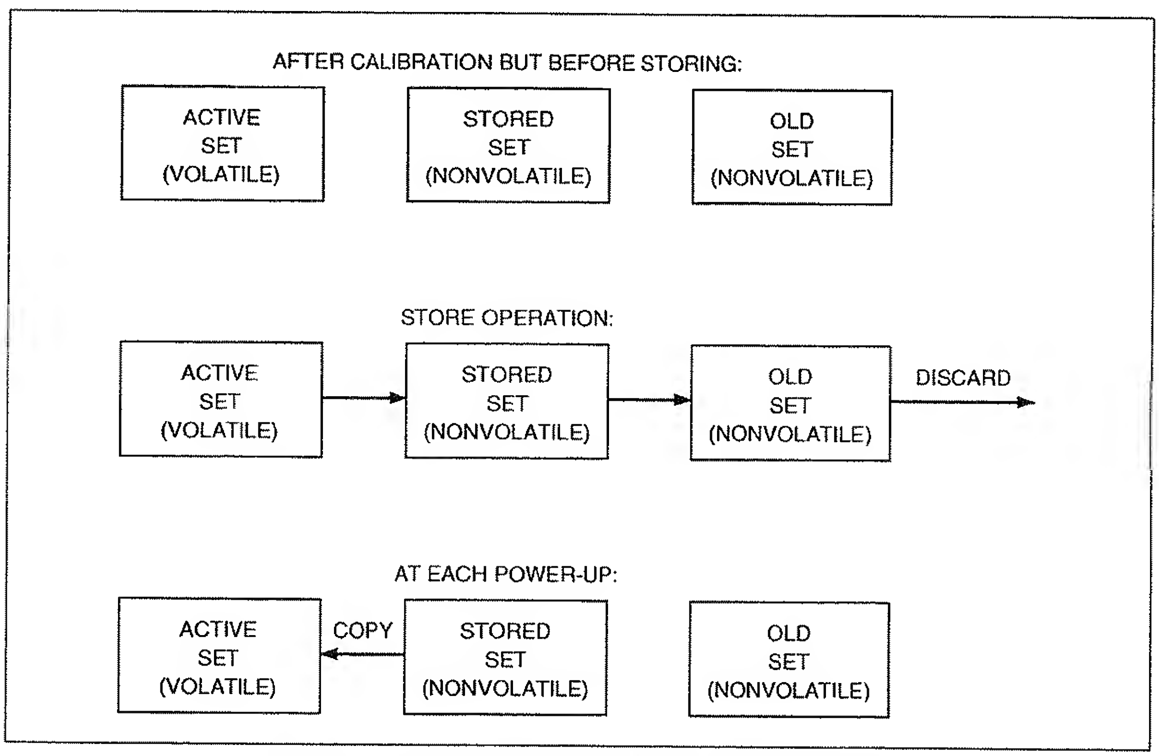


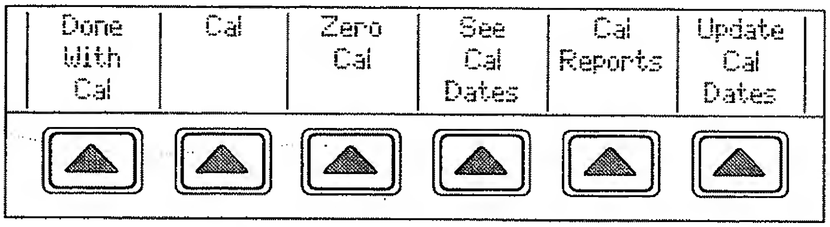
Figure 3-1. 5790A Calibration Memory Organization

NOTE

For a theoretical discussion of calibration constants, refer to Section 2.

How to Use the Calibration Menus 3-7.

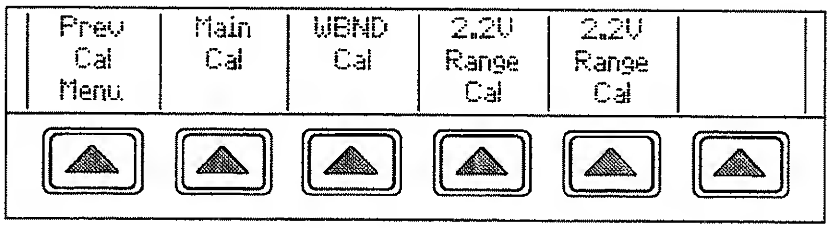
When you press the [UTIL MENUS] key followed by the "Cal" softkey. The top-level calibration menu appears as shown below:



The functions of the softkeys and the location of related instructions are described next.

THE CAL MENU 3-8.

Assuming that the CALIBRATION MODE switch is in the PERIODIC position, the "Cal" softkey produces the following menu:



The functions of the softkeys in this menu are as follows:

- Main Cal: starts dc and ac calibration of the main input. The procedure is described under "Calibrating the Main Input" in this section. (This softkey is "Service Cal" if the CALIBRATION MODE switch is in the SERVICE position.)
- WBND Cal: appears only if the Wideband AC option is installed. It starts absolute (gain) and flatness calibration of the Wideband option. The procedure is described under "Calibrating the Wideband AC Option" in this section.
- 2.2V Range AC Cal: provides quick access to the main input ac calibration steps of a single range. The procedure is the same as for "Calibrating the Main Input" in this section. The range showing depends on the range that is presently selected.
- 2.2V Range DC Cal: provides quick access to the main input dc calibration steps of a single range. The procedure is the same as for "Calibrating the Main Input" in this section. The range showing depends on the range that is presently selected.

NOTE

If the CALIBRATION MODE switch is in the SERVICE position, a softkey for "Xfer Offset Adjust" appears in the top-level calibration menu. It generates a display with a pointer that helps you make an internal adjustment on the Transfer assembly. The adjustment removes the offset in the millivolt input amplifier stage, and is required only following repair or replacement of that assembly. Instructions for this adjustment are described under "Service Calibration".

ZERO CAL SOFTKEY 3-9.

Starts the Zero Calibration procedure described in Section 4 of the Operator Manual. It is recommended that you perform this brief, automatic procedure at least every 30 days. The setting of the CALIBRATION STORE or MODE switches does not matter for Zero Calibration.

SEE CAL DATES SOFTKEY 3-10.

This softkey displays the dates of the last zero calibration, main calibration, service calibration (normally when the 5790A was built), and Wideband option calibration (if installed).

CAL REPORTS SOFTKEY 3-11.

This softkey produces a menu that lets you print one of the following types of calibration reports through the serial interface:

- MEASUREMENT SHIFTS: STORED VS. OLD: Use this report at any time to see the shifts that occurred at the last stored calibration.

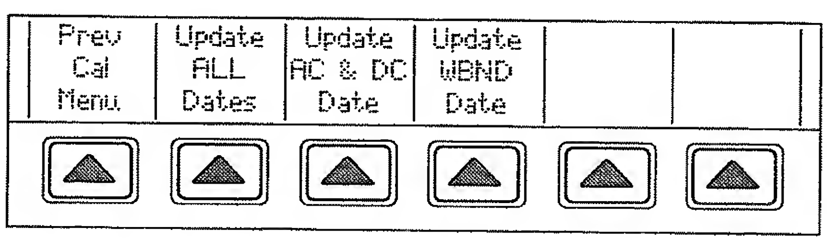
NOTE

A report of ACTIVE VS. STORED measurement shifts is offered only after you have completed a calibration process and not yet stored the updated constants.

- CALIBRATION CONSTANTS: Print this report to list the active, stored, and old set of calibration constant names and values. There are many different types of constants for each calibration point that correct gain, zero, dc turnover, and flatness errors.

UPDATE CAL DATES MENU 3-12.

Pressing the Update Cal Dates softkey produces the following menu:



There is only one case in which you would use these functions: If you perform a complete main input calibration or wideband calibration process and not a single significant shift was detected, you press one of these keys to update the date and temperature of the stored set of calibration constants to the current date. The rear panel CALIBRATION STORE switch must be set to ENABLE to update cal dates. Updating the calibration date in this way does not generate a new set of calibration constants.

PERIODIC CALIBRATION 3-13.

The following information describes how to calibrate the 5790A to external standards. You can substitute either manual or automated equivalent equipment and methods, for the following calibration procedures, but only if the equipment and standards used have uncertainties equal to or better than specified. During 5790A calibration, select the fast, medium, or slow filter.

Calibrating the Main Input 3-14.

Calibrate INPUT1 or INPUT2 by using the following sequence of procedures:

1. Characterize the dc source
2. Perform dc calibration
3. Perform ac calibration

Throughout dc and ac calibration, the Control Display prompts you with the next step and informs you of the progress of calibration. The number of calibration steps depends on whether the CALIBRATION MODE switch is set to PERIODIC or SERVICE. The cable connections for the dc and ac calibration are kept as similar as possible so that a minimum of mechanical changes are required during the procedure.

CHARACTERIZING THE DC SOURCE 3-15.

To meet the test uncertainty requirements for 5790A main input dc calibration, you must first characterize (i.e., calibrate to a higher uncertainty than the published specifications) the dc function of the 5700A at the required points. Table 3-1 lists the equipment required for dc source characterization. Tables 3-2 and 3-3 comprise the test record in which you will record the results of the following procedure. Make a photocopy of these two tables before you proceed.

WARNING

SOME STEPS IN THE FOLLOWING PROCEDURE INVOLVE CALIBRATOR OUTPUTS AT LETHAL VOLTAGES. USE EXTREME CARE NOT TO TOUCH ANY EXPOSED CONDUCTORS.

1. Warm up all equipment for the period specified in the manufacturer's manual. The 720A and 752A should be allowed to "soak" in the lab environment for at least 8 hours prior to use for best results.
2. Self calibrate the 720A and 752A in accordance with their instruction manuals.

Table 3-1. Equipment Required for 5700A DC Characterization

EQUIPMENT	MANUFACTURER AND MODEL	MINIMUM USE SPECIFICATIONS
Multifunction Calibrator to Characterize for 5790A dc calibration	Fluke 5700A**	0-1000V dc, short-term stability better than 1 ppm
DC Voltage Calibrator	Fluke 5440B	0 to 11V dc, short-term stability better than 1 ppm, 1 µV resolution
Kelvin-Varley Divider	Fluke 720A	0.1 ppm terminal linearity
Reference Divider	Fluke 752A	Uncertainty +\-0.5 ppm @ 100:1, ±0.2 ppm @ 10:1
Null Detector	Fluke 845A( )*	0.1 µV resolution
10V DC Reference Standard	Fluke 732A or B	10V Uncertainty ±1 ppm

* Throughout this manual, whenever 845() is referenced, 845AB or 845AR is applicable.

**The 5700A must contain software Rev. E or higher. Rev. E and higher software includes the Xfer Off function, which is required during ac calibration of the 5790A main input.

3. Connect the equipment as shown in Figure 3-2.
4. Set the ratio dials of the 720A to represent the certified value of the 732A. (For example, 10.000123V becomes 1.0000123 on the 720A).
5. Set the 845A() to the 30 mV range and the OPR/ZERO switch to ZERO.
6. Set the 5440B to 11V, OPERATE. Set the 845A() OPR/ZERO switch to OPR, reducing the range switch until the largest on-scale reading is obtained. Edit the 5440B output until a null is indicated on the 845A(). Again reduce the range switch setting until the largest on-scale reading is obtained, editing the 5440B output for a null. Repeat this procedure until you obtain a null of ±1 μV. Set the 845A() OPR/ZERO switch to ZERO. The 5440B/720A combination is now calibrated in absolute voltage relative to the 732A.

NOTE

For the remainder of this procedure, the 5700A EXT GUARD must be selected (keycap LED lit), and the strap between V-GUARD and GROUND must be removed.

7. Connect the equipment as shown in Figure 3-3.
8. Set the 752A to OPERATE, MODE to 1000V. Set the 720A dials to 1.0000000. Set the 845A() to the 10 mV range.

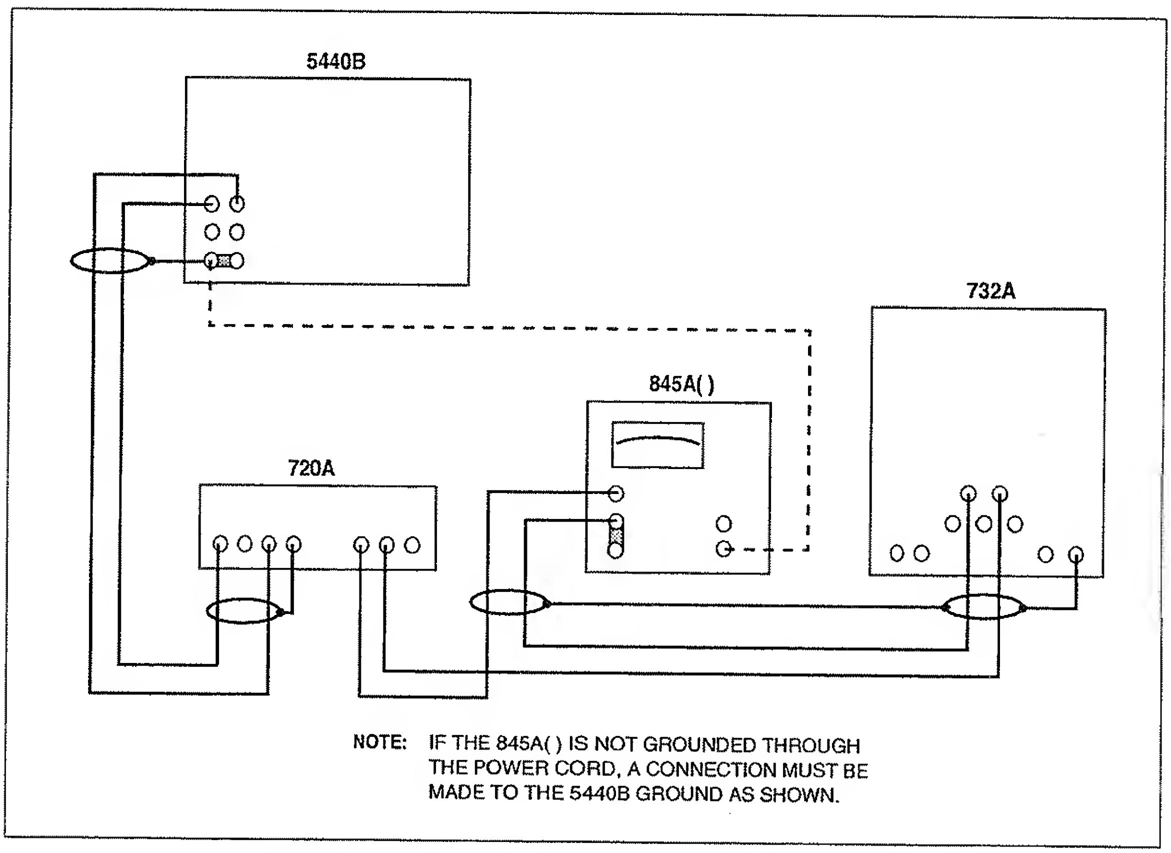


Figure 3-2. DC Source Characterization Setup, Part 1

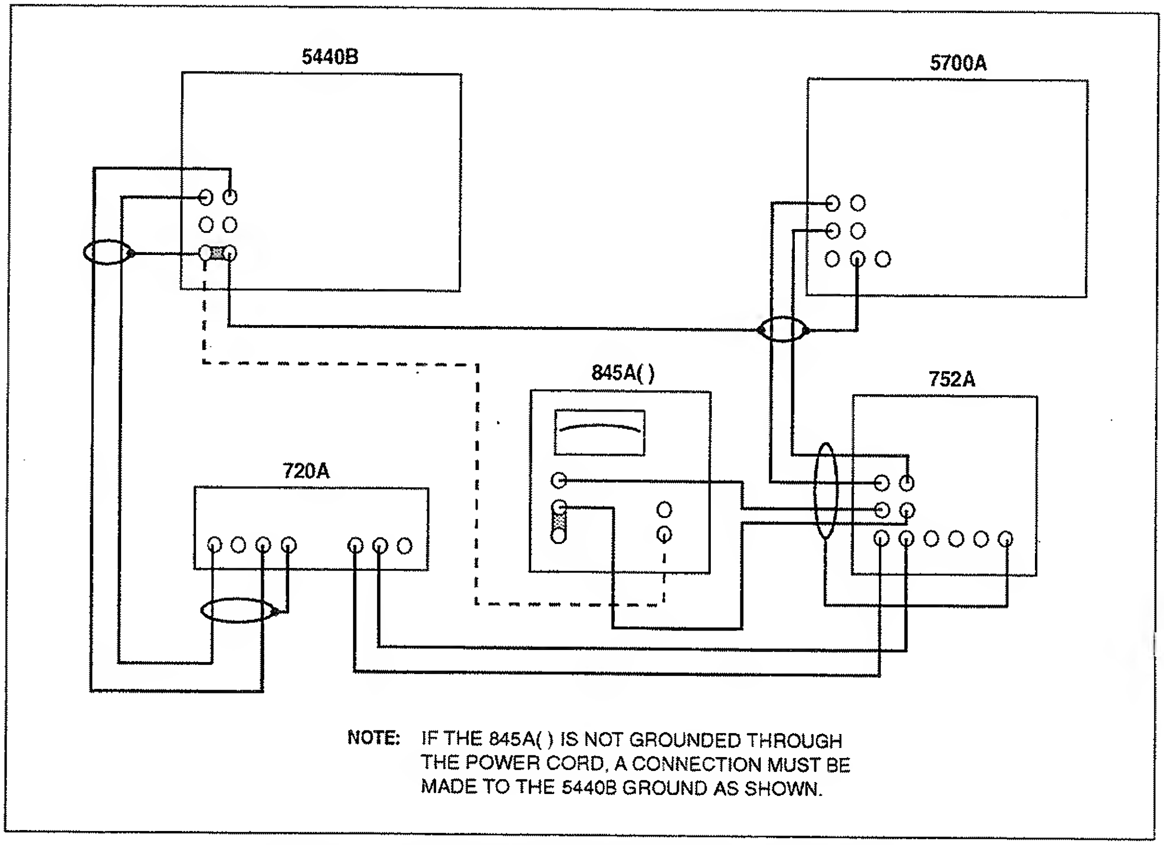


Figure 3-3. DC Source Characterization Setup, Part 2

9. Set the 5700A to 1000V, OPERATE. Set the 845A() to OPR. Reduce the 845A() range switch setting until the largest on-scale reading is obtained. Adjust the 5700A for a null. Repeat this procedure until you obtain a null of ±1 µV. Set the 845A() OPR/ZERO to ZERO and set the 5700A to STANDBY. Record the 5700A Error Display indication in Table 3-2 under the column "5700A ERROR DISPLAY INDICATION TO OBTAIN CHARACTERIZED NOMINAL OUTPUT," opposite +1000V.

10. Set the 720A dials to 0.6000000. Set the 5700A to 600V, OPERATE. Set the 845A() to the 10 mV range. Repeat the nulling procedure of step 9, recording the 5700A Error Display indication opposite +600V in Table 3-2. Set the 5700A to STANDBY.

11. Set the 720A dials to 0.2000000. Set the 5700A to 200V, OPERATE. Set the 845A() to the 10 mV range. Repeat the nulling procedure of step 9, recording the 5700A Error Display indication opposite +200V in Table 3-2. Set the 5700A to STANDBY.

12. Press CHNG SIGN on the 5440B. Set the 845A() to the 10 mV range. Set the 5700A to -200V, OPERATE. Repeat the nulling procedure of step 9, recording the 5700A Error Display indication opposite -200V in Table 3-2. Set the 5700A to STANDBY.

13. Set the 720A dials to 0.6000000. Set the 5700A to -600V, OPERATE. Set the 845A() to the 10 mV range. Repeat the nulling procedure of step 9, recording the 5700A Error Display indication opposite -600V in Table 3-2. Set the 5700A to STANDBY.

Table 3-2. 5700A DC Characterization Test Record, Part 1

5790A CALIBRATION DC REQUIREMENT (V)	845A() FINAL NULL (± uV)	5700A ERROR DISPLAY INDICATION TO OBTAIN CHARACTERIZED NOMINAL OUTPUT
+1000	1	
+600	1	
+200	1	
-200	1	
-600	1	
-1000	1	
-60	1	
-20	1	
+20	1	
+60	1	
+6	1	
+2	1	
-2	1	
-6	1	

14. Set the 720A dials to 1.0000000. Set the 5700A to -1000V, OPERATE. Set the 845A() to the 10 mV range. Repeat the nulling procedure of step 9, recording the 5700A Error Display indication opposite -1000V in Table 3-2. Set the 5700A to STANDBY.
15. Set the 752A MODE switch to 100V.
16. Repeat steps 10 through 14 for 5700A outputs of -60, -20, +20, and +60V dc, entering the Error Display indications for each in Table 3-2.
17. Set the 752A MODE switch to 10V.
18. Repeat steps 10 through 14 for 5700A outputs of +6, +2, -2, and -6V dc, entering the Error Display indications for each in Table 3-2.
19. Disconnect the 720A and 5440B from the 752A. Make the connections shown in Figure 3-4.
20. Set the 5700A to 6V, OPERATE. Edit the 5700A output until the Error Display matches that recorded in Table 3-2 for a +6V output. Set the 5440B to 6V, OPERATE. Set the 845A() range to 10 mV. Set the 845A() to OPR. Reduce the 845A() range switch setting until the largest on-scale reading is obtained. Adjust the 5440B output for a null. Repeat this procedure until until you obtain a null of ±1 μV. Set the 845A() OPR/ZERO to ZERO and set the 5700A to STANDBY. Record the 5440B voltage indication in Table 3-3 after "5440B CHARACTERIZED 6V OUTPUT". Set the 5440B to STANDBY.
21. Set the 5700A to 2V, OPERATE. Set the 5440B to 2V, OPERATE. Edit the 5700A output until the Error Display matches that recorded in Table 3-2 for a +2V output. Set the 845A() range to 10 mV. Set the 845A() OPR/ZERO to OPR. Reduce the 845A() range switch setting until the largest on-scale reading is obtained. Adjust the 5440B for a null. Repeat this procedure until you obtain a null of ±1 μV. Set the

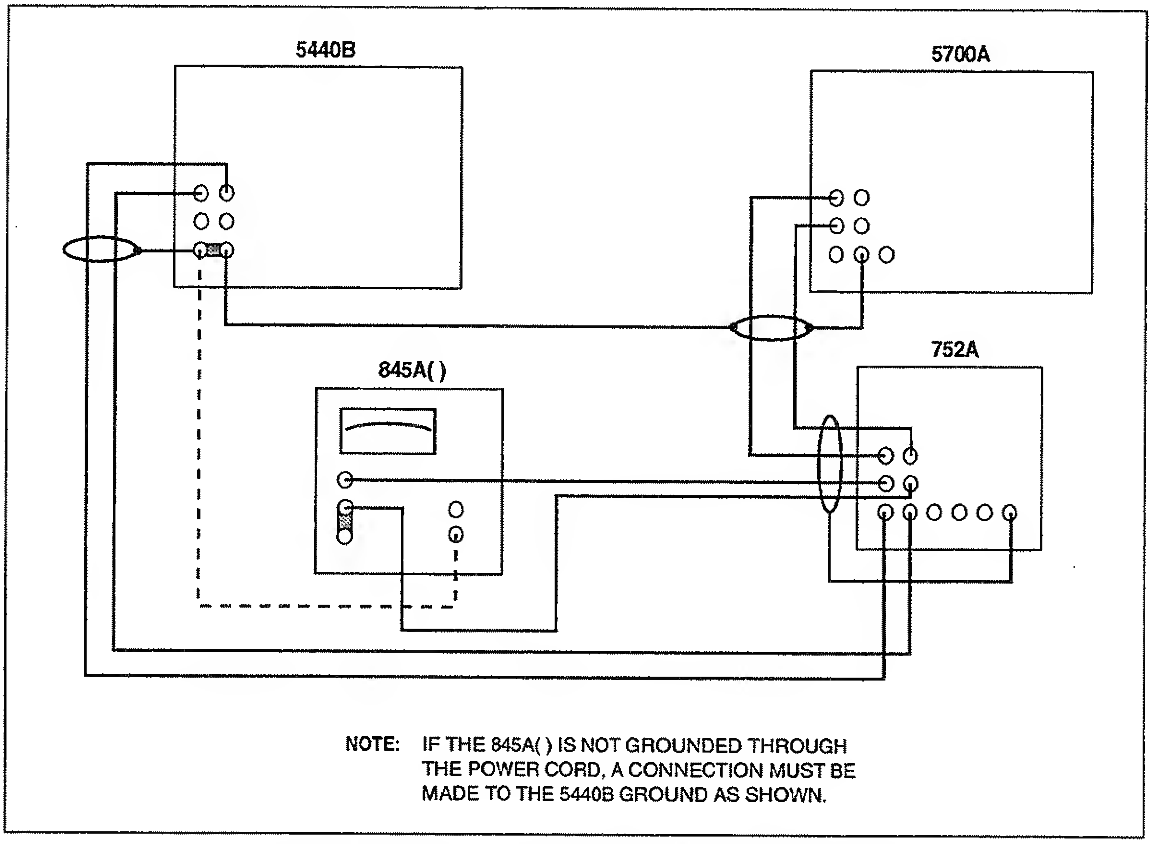


Figure 3-4. DC Source Characterization Setup, Part 3

845A() OPR/ZERO to ZERO and set the 5700A to STANDBY. Record the 5440B Voltage indication in Table 3-3 after "5440B CHARACTERIZED 2V OUTPUT". Set the 5440B to STANDBY.

22. Set the 752A MODE switch to 1V.

23. Set the 5440B output to the characterized 6V output recorded in Table 3-3, OPERATE. Set the 5700A to +0.6V, OPERATE. Set the 845A() to the 10 mV range. Reduce the 845A() range switch setting until the largest on-scale reading is obtained. Adjust the 5700A for a null. Repeat this procedure until you obtain a null of ±0.1 µV. Record the 5700A Error Display indication opposite +0.6V in Table 3-3. Set the 5700A to STANDBY.

24. Press CHNG SIGN on the 5440B. Set the 5700A to -0.6V, OPERATE. Set the 845A() to the 10 mV range. Repeat the nulling procedure of step 26, recording the 5700A Error Display indication opposite -0.6V in Table 3-3. Set the 5700A to STANDBY.

25. Set the 5440B output to the characterized 2V output recorded in Table 3-3, OPERATE. Set the 5700A to +0.2V, OPERATE. Set the 845A() to the 10 mV range. Repeat the nulling procedure of step 26, recording the 5700A Error Display indication opposite +0.2V in Table 3-3. Set the 5700A to STANDBY.

26. Press CHNG SIGN on the 5440B. Set the 5700A to -0.2V, OPERATE. Set the 845A() to the 10 mV range. Repeat the nulling procedure of step 26, recording the 5700A Error Display indication opposite -0.2V in Table 3-3. Set the 5700A to STANDBY.

27. Set the 752A MODE switch to 0.1V.

Table 3-3. 5700A DC Characterization Test Record, Part 2

CHRACTERIZED 5440B 6V OUTPUT:		
CHRACTERIZED 5440B 2V OUTPUT:		
5790A CALIBRATION DC REQUIREMENT (V)	845A() FINAL NULL (± uV)	5700A ERROR DISPLAY INDICATION TO OBTAIN CHARACTERIZED NOMINAL OUTPUT
+0.6	0.1	
-0.6	0.1	
+0.2	0.1	
-0.2	0.1	
+0.06	0.1	
-0.06	0.1	
+0.02	0.1	
-0.02	0.1	
+0.006	0.1	
-0.006	0.1	
+0.002	0.1	
-0.002	0.1	

28. Repeat the procedure described in steps 26 through 29 for 5700A outputs of +0.06, -0.06, +0.02, and -0.02V, entering the Error Display indications in Table 3-3.

NOTE

It is not necessary to characterize the 5440B prior to performing the following steps in order to meet the test uncertainty requirements for the 5790A.

29. Set the 5440B to output 0.6V. Repeat the procedure described in steps 26 and 27 for 5700A outputs of +0.006 and -0.006V, entering the Error Display indications in Table 3-3.

30. Set the 5440B to output 0.2V. Repeat the procedure described in steps 27 and 28 for 5700A outputs of +0.002 and -0.002V, entering the Error Display indications in Table 3-3.

31. DC source characterization is now complete. Set all outputs to standby and remove all connections.

DC CALIBRATION 3-16.

Table 3-4 lists the equipment required for dc calibration of the main input. Proceed as follows to perform dc calibration of the main input, which is always the prerequisite for ac calibration. Use the 5700A you characterized in the previous procedure as the dc source.

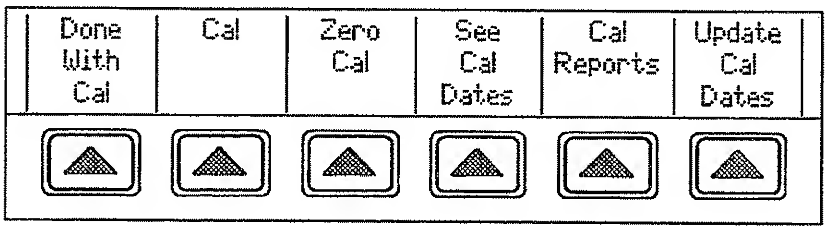
1. Set the rear panel CALIBRATION MODE switch to PERIODIC. You do not need to change the setting of the CALIBRATION STORE switch yet.

2. Set up the equipment as shown in Figure 3-5. A shielded twisted pair is recommended for the 5700A SENSE leads.

NOTE

Thermal emf errors can adversely affect ac-dc transfers used in the following procedures. To minimize thermal emf errors, use low thermal emf cables and connectors and avoid changing the temperature of any connection during a procedure. It typically takes five minutes to thermally stabilize a connection after it has been touched.

3. Turn on the 5790A and 5725A and allow 30 minutes warmup time.
4. Set the 5700A to EXT SENSE and EXT GUARD. Verify that there is a heavy braid strap between GUARD and OUTPUT LO. Set the 5790A to INT GUARD.
5. Press the [UTIL MENUS] key followed by the "Cal" softkey. The top-level calibration menu appears:



6. Press the "Cal" softkey. The display changes to:

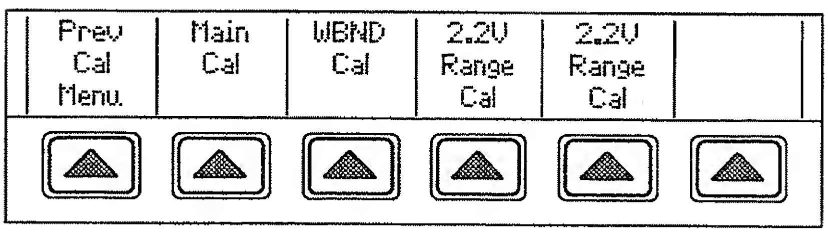


Table 3-4. Equipment Required for 5790A Main Input DC Calibration

EQUIPMENT	MANUFACTURER AND MODEL
Multifunction Calibrator	Fluke 5700A*
50Ω Type "N" Coaxial Tee Male-Male-Male	Amphenol 4850 or equivalent
50Ω Type "N" Female to Double Banana Plug Adapter	Pomona Model 1740 or Equivalent
Binding Posts to 50Ω Type "N" Male Adapter	Pomona Model 1796 or Equivalent
Low-Thermal Test Leads	Fluke 5440B-7002 or equivalent (two sets)
*The 5700A must be characterized for dc using the procedure in this section	

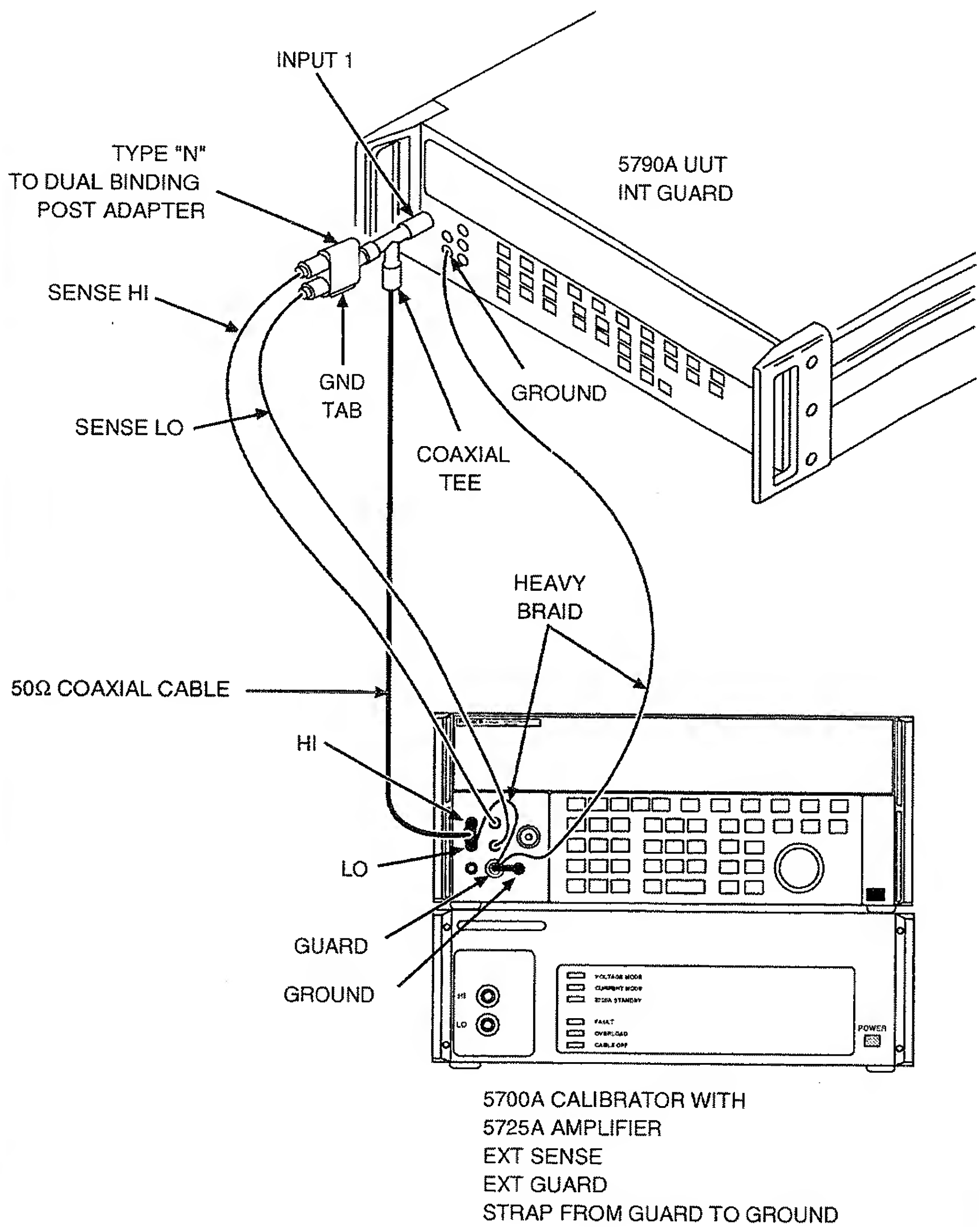
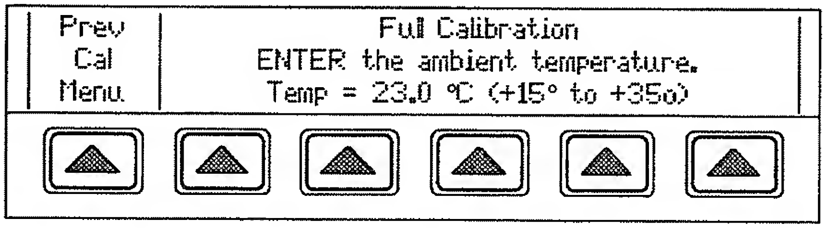


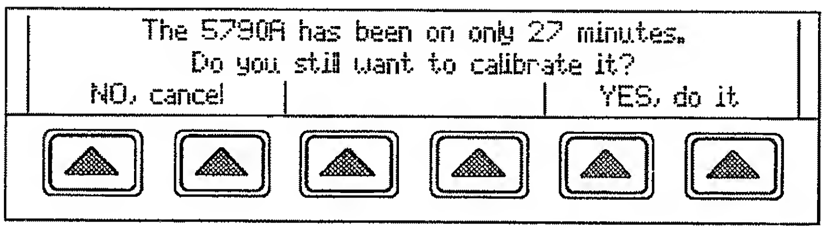
Figure 3-5. 5790A DC Calibration Test Setup

7. Press the "Main Cal" softkey. The display changes to:

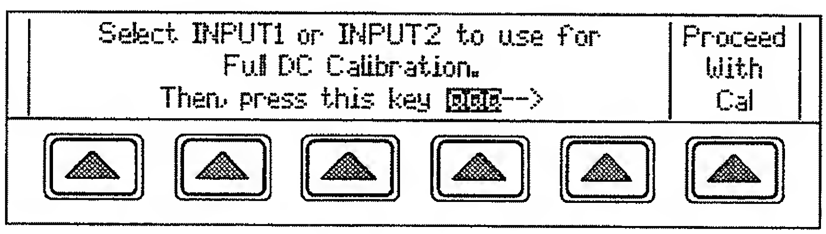


NOTE

The following display appears if the 5790A has not been turned on for at least 30 minutes. If you know that warmup requirements are met, for example if you briefly turned off the power, press "YES, do it" to override.



8. Enter the ambient temperature using the numeric keypad (the numbers appear below the keys) and press the [ENTER] key. Or to accept the default of 23.0°C, just press [ENTER].



9. Press the [INPUT1] key so that its keycap indicator is lit. Press the "Proceed With Cal" softkey. The display changes to:

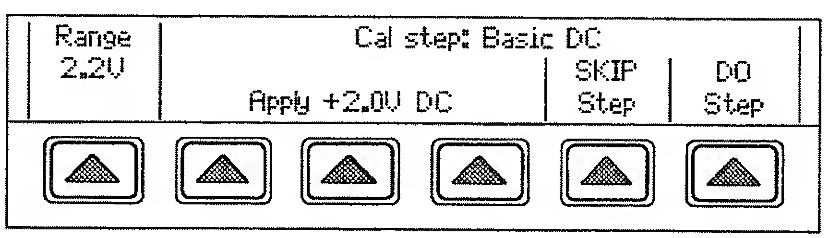


Table 3-5. Calibration Steps in Periodic Calibration

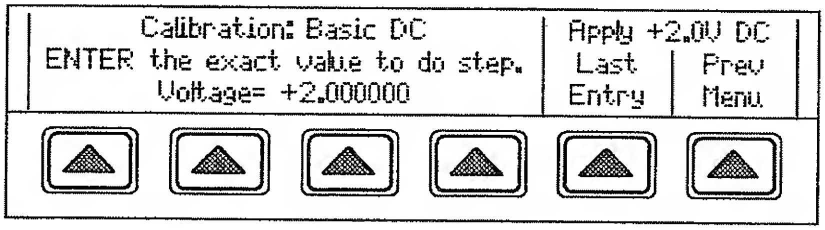
STEP NAME	VOLTAGE TO APPLY	TOLERANCE OF CALIBRATION SOURCE (± PPM)	PURPOSE OF CALIBRATION STEP
Basic DC	+2V dc	3	Calibrates DACs and thermal sensor. (This is the unscaled range.)
Sensor turnover -2.0	-2V dc	3	Corrects dc turnover error
Sensor turnover +0.7 Sensor turnover -0.7	+0.7V dc -0.7V dc	5	Corrects turnover error of the rms sensor at minimum scale. After the -0.7V step, internally calibrates the range zeros.
1000V Positive DC 1000V Negative DC	+1000V dc -1000V dc	3	Establishes gain and dc offset for the 1000V range
700V Positive DC 700V Negative DC	+600V dc -600V dc	3	Establishes gain and dc offset for the 700V range
220V Positive DC 220V Negative DC	+200V dc -200V dc	3	Establishes gain and dc offset for the 220V range
70V Positive DC 70V Negative DC	+60V dc -60V dc	3	Establishes gain and dc offset for the 70V range
22V Positive DC 22V Negative DC	+20V dc -20V dc	3	Establishes gain and dc offset for the 22V range
7V Positive DC 7V Negative DC	+6V dc -6V dc	3	Establishes gain and dc offset for the 7V range
2.2V Positive DC 2.2V Negative DC	+2V dc -2V dc	3	Establishes gain and dc offset for the 2.2V range
700 mV Positive DC 700 mV Negative DC	+600 mV dc -600 mV dc	5	Establishes gain and dc offset for the 700 mV range
220 mV Positive DC 220 mV Negative DC	+200 mV dc -200 mV dc	10	Establishes gain and dc offset for the 220 mV range
70 mV Positive DC 70 mV Negative DC	+60 mV dc -60 mV dc	35	Establishes gain and dc offset for the 70 mV range
22 mV Positive DC 22 mV Negative DC	+20 mV dc -20 mV dc	100	Establishes gain and dc offset for the 22 mV range
7 mV Positive DC 7 mV Negative DC	+6 mV dc -6 mV dc	350	Establishes gain and dc offset for the 7 mV range
2.2 mV Positive DC 2.2 mV Negative DC	+2 mV dc -2 mV dc	1000	Establishes gain and dc offset for the 2.2 mV range
LF (10 Hz) Linearity LF (10 Hz) Linearity	2V rms, 10 Hz 600 mV rms, 10 Hz	190	Generates a correction for thermal sensor non-linearity at low F and f

Table 3-5. Calibration Steps in Periodic Calibration (cont)

STEP NAME	VOLTAGE TO APPLY	TOLERANCE OF CALIBRATION SOURCE (± PPM)	PURPOSE OF CALIBRATION STEP
1000V AC 100 kHz	600V rms, 100 kHz	70	Generates flatness calibration data for the 1000V range
700V AC 100 kHz	600V rms, 100 kHz	70	Generates flatness calibration data for the 700V range
220V AC 300 kHz	60V rms, 300 kHz	130	Generates flatness calibration data for the 220V range
70V AC 500 kHz 70V AC 1 MHz	20V rms, 500 kHz 20V rms, 1 MHz	125 125	Generates flatness calibration data for the 70V range
22V AC 100 kHz 22V AC 1 MHz	20V rms, 100 kHz 20V rms, 1 MHz	50 125	Generates flatness calibration data for the 22V range
7V AC 100 kHz 7V AC 1 MHz	6V rms, 100 kHz 6V rms, 1 MHz	50 125	Generates flatness calibration data for the 7V range
2.2V AC 1 MHz	2V rms, 1 MHz	125	Generates flatness calibration data for the 2.2V range
700 mV AC 1 MHz	600 mV rms, 1 MHz	140	Generates flatness calibration data for the 700 mV range
220 mV AC 1 MHz	200 mV rms, 1 MHz	300	Generates flatness calibration data for the 220 mV range
70 mV AC 300 kHz 70 mV AC 1 MHz	60 mV rms, 300 kHz 60 mV rms, 1 MHz	500 600	Generates flatness calibration data for the 70 mV range
22 mV AC 300 kHz 22 mV AC 1 MHz	20 mV rms, 300 kHz 20 mV rms, 1 MHz	720* 720*	Generates flatness calibration data for the 22 mV range
7 mV AC 300 kHz 7 mV AC 1 MHz	6 mV rms, 300 kHz 6 mV rms, 1 MHz	1200* 1200*	Generates flatness calibration data for the 7 mV range
2.2 mV AC 300 kHz 2.2 mV AC 1 MHz	2 mV rms, 300 kHz 2 mV rms, 1 MHz	2300* 2300*	Generates flatness calibration data for the 2.2 mV range

*These uncertianties can be achieved using the “bootstrap” techniques described in the ac calibration procedure

10. Set the 5700A to nominal, then use the knob to adjust for the error display you recorded in Table 3-3. Set the 5700A to operate. When the U (unsettled) indicator on the 5700A goes out, press the "DO Step" softkey. The Control Display changes to:



11. At each step you accept the default value by pressing [ENTER]. You do this because you have already applied your correction in the adjusted 5700A setting. The display tells you that the calibration step is in progress and informs you with a beep when the step is complete.

12. When the 5790A completes the step, the next dc step, which requires -2V dc, is presented on the display. Change the 5700A setting accordingly and do the calibration step as in the previous two steps.

WARNING

SOME STEPS IN THE REMAINDER OF THIS PROCEDURE REQUIRE APPLICATION OF LETHAL VOLTAGES. USE EXTREME CAUTION TO AVOID CONTACT WITH LIVE CONDUCTORS. SET THE CALIBRATOR TO STANDBY AND VERIFY THAT VOLTAGE HAS RETURNED TO ZERO IMMEDIATELY AFTER EACH HIGH VOLTAGE CALIBRATION STEP IS FINISHED.

NOTE

For the 200 mV points and below, remove the external sense leads and set the 5700A to INT SENSE.

Table 3-6. Equipment Required for 5790A Main Input AC Calibration

EQUIPMENT	MANUFACTURER AND MODEL
6-1/2-Digit DMM	Fluke 8506A (NOTE 1)
Multifunction Calibrator	Fluke 5700A (NOTE 2)
Amplifier for Above	Fluke 5725A (for higher Volt-Hertz product)
Reference Transfer Standard	Fluke 792A
50Ω Type "N" Coaxial Tee Male-Male-Male	Amphenol 4850 or equivalent
50Ω Type "N" Female to Double Banana Plug Adapter	Pomona Model 1740 or Equivalent
Binding Posts to 50Ω Type "N" Male Adapter	Pomona Model 1796 or Equivalent

NOTE 1: If you do not have the Wideband option, an 8505A can be substituted
NOTE 2: The 5700A must be characterized for dc using the procedure in this section, and must contain software Rev. E or higher. Rev. E and higher software includes the Xfer Off function.

VOLTAGE (NOMINAL) ______________________

FREQUENCY ______________________

792A CORRECTION (PPM) ______________________

	792A	5790A
+DC		
–DC		
$DC_{AVERAGE}$	$DC_{792} =$	$DC_{5790} =$
AC_{792}		X
AC_{MEAS}		

$$DC_{AVERAGE} = \left(\frac{|{+DC}| + |{-DC}|}{2}\right)$$

$$AC_{MEAS} = DC_{5790} \bullet \left(\frac{AC_{792}}{DC_{792}} + \frac{792\ CORR}{10^6}\right)$$

EXAMPLE:

VOLTAGE (NOMINAL) 2.0V

FREQUENCY 10 Hz

792A CORRECTION (PPM) +14

	792A	5790A
+DC	1.713135	1.999799
-DC	1.713146	1.999801
$DC_{AVERAGE}$	DC_{792} = 1.713141	DC_{5790} = 1.999800
AC_{792}	1.713188	X
AC_{MEAS}	1.999858	

$$DC_{792} = \frac{1.713135 + 1.713146}{2} = 1.713141$$

$$DC_{5790} = \frac{1.999799 + 1.999801}{2} = 1.999800$$

$$AC_{MEAS} = 1.999800 \left(\frac{1.713188}{1.713141} + \frac{+14}{10^6}\right) = 1.999858$$

Figure 3-6. Worksheet for 2V to 1000V AC Calibration Points

VOLTAGE (NOMINAL) ______________________

FREQUENCY ______________________

5700A ERROR DISPLAY FROM TABLE 3-3, POSITIVE ______________________

5700A ERROR DISPLAY FROM TABLE 3-3, NEGATIVE ______________________

792A CORRECTION (PPM) ______________________

	792A DMM READING
+DC	
−DC	
DC_{792}	
AC_{792}	
AC_{MEAS}=	

$$DC_{792} = \left(\frac{|+DC| + |-DC|}{2}\right)$$

$$AC_{MEAS} = NOMINAL \bullet \left(\frac{AC_{792}}{DC_{792}} + \frac{792\ CORR}{10^6}\right)$$

Figure 3-7. Worksheet for 60 mV to 600 mV AC Calibration Points

13. Continue until dc calibration is finished. Table 3-5 lists the steps in periodic calibration of the main input. The 2.2 mV range is the last dc calibration step.

AC CALIBRATION 3-17.

Table 3-6 lists the equipment required to perform ac calibration of the main input. Before you begin, make 12 copies of Figure 3-6 and 10 copies of Figure 3-7. Those are worksheets to help you calibrate the various ac points.

Proceed as follows to perform ac calibration of the main input, which must always be preceded by dc calibration:

1. Set up the equipment as shown in Figure 3-8. Connect the 792A without the 1000V range resistor first.
2. Set up the 5700A as follows so that its internal ac transfers are off:
   a. Press the "Setup Menus" softkey.
   b. Press the "Special Functns" softkey.
   c. Press the "ACXfer Choice" softkey so that ON appears.
   d. Press PREV MENU twice.
   e. Set the 5700A to 1V, 1 kHz, operate. Press the "Intrnl Xfers" softkey so that OFF appears. (The "Intrnl Xfers" softkey appears only in the 5700A ranges below 220V and at frequencies below 120 kHz.)

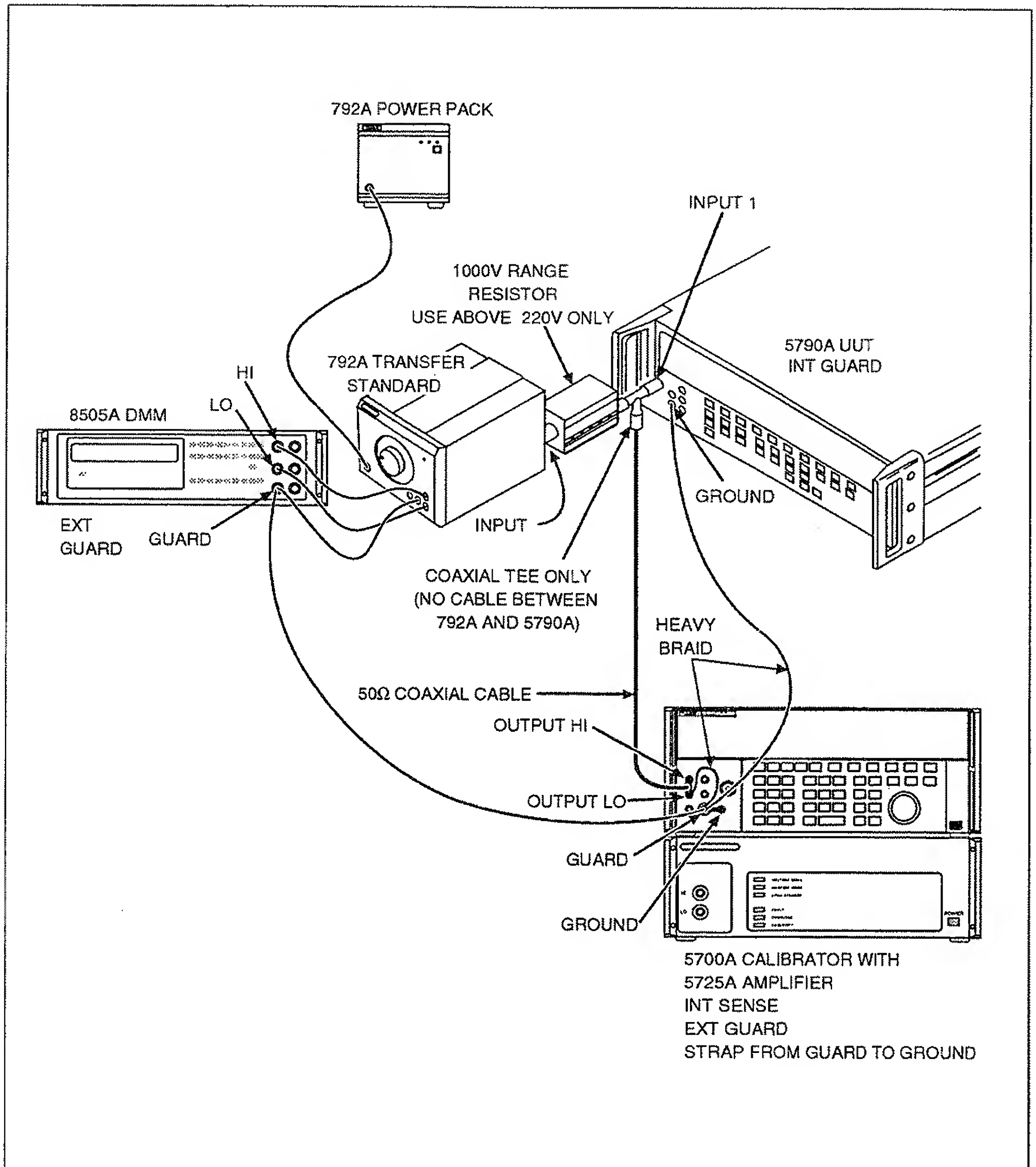
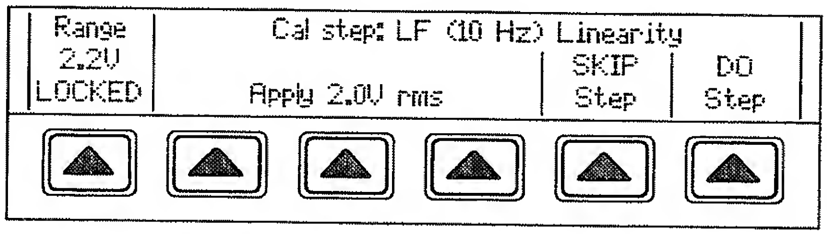


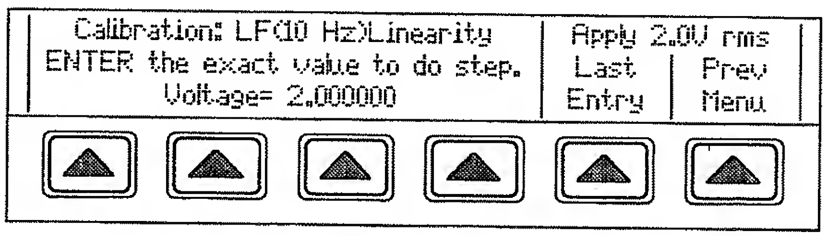
Figure 3-8. 5790A AC Calibration Test Setup

f. Press 0, V, 0, HZ, ENTER, on the 5700A. Leave the 5700A in standby.

3. The display prompts you for INPUT1 or 2. Verify that the [INPUT1] keycap indicator is lit. Press the "Proceed With Cal" softkey. The display changes to:



4. Press the "DO Step" softkey. The display changes to:



5. For all ac cal points down to the 70 mV range, you use the Fluke 792A AC/DC Transfer Standard to adjust the ac voltage level being applied to the 5790A INPUT1 connector. There are three procedures for ac calibration points, depending on their amplitude. Go to the appropriate step as defined below:

- Step 6: 2V through 600V
- Step 7: 60 mV through 600 mV
- Step 8: 2 mV through 20 mV

6. For an ac calibration point in the 2V through 1000V range, proceed as follows:

a. Obtain a copy of Figure 3-6, the worksheet for this group. Fill in the test voltage and frequency and the associated 792A correction.

b. If the test voltage is above 220V, add the 792A 1000V range resistor to the test setup as shown in Figure 3-8.

c. Press the "DO Step" softkey. This automatically selects the correct 5790A range.

d. Set the 792A INPUT RANGE knob to the appropriate position. Always use the lowest range that will accept the input.

CAUTION

Always ensure that the proper range has been selected before applying voltage to the 792A input. Inputs that exceed the protection level shown on its rear panel label disrupt the state of calibration and can cause instrument damage.

e. Set the 5700A to the nominal test voltage, dc positive. (Do not use a characterized setting as the 5790A is now used as the dc reference, thus allowing for any resistive drop caused by the 792A loading.) Wait for the 5700A "U" annunciator to go out.

f. Wait 30 seconds for the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for +DC. Record the reading on the 5790A Output Display under the 5790A column for +DC.

g. Press [±] [ENTER] on the 5700A to toggle output polarity.

h. Again, allow the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for -DC. Record the reading on the 5790A Output Display under the 5790A column for -DC. Ignore polarity for the 5790A reading. (Record the absolute value.)

i. Apply the frequency required for the calibration step. Wait for the "U" annunciator on the 5700A to go out.

j. Allow the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for AC. Do not record a reading for the 5790A.

k. Now do a computation to get measured ac using the formulas shown in the worksheet:

   1. Compute the average of the dc readings for the 5790A and the 792A as shown.
   2. Compute "AC MEAS" using the formula shown. Be sure to include the 792A correction as indicated in the formula.

l. Observe the default "EXACT VALUE" on the display. It shows the allowed number of decimal places for you to enter. Enter your computation of "AC MEAS" in the 5790A using the keypad, and press the [ENTER] key. After you press [ENTER], the Control Display shows the progress of the internal process of the calibration step.

NOTE

While a calibration step is in progress, inaccurate values may appear on the Measurement Display. This is normal. When the 5790A is finished with the step, the display will read accurately.

m. When the step has completed, set the 5700A to standby.

7. For an ac calibration point in the 60 mV through 600 mV group, you will need to adjust the 5700A in accordance with the error displays that you recorded in Table 3-3. Proceed as follows:

   a. Obtain a copy of Figure 3-7, the worksheet for this group. Fill in the voltage, frequency, 5700A error displays (positive and negative) from Table 3-3, and the associated 792A correction.

   b. Press the "DO Step" softkey. This automatically selects the appropriate 5790A range.

   c. Set the 792A INPUT RANGE knob to the appropriate position. Always use the lowest range that will accept the input.

CAUTION

Always ensure that the proper range has been selected before applying voltage to the 792A input. Inputs that exceed the protection level shown on its rear panel label disrupt the state of calibration and can cause instrument damage.

   d. Set the 5700A to nominal positive, then turn the knob to obtain the error display reading you recorded in Table 3-3. Wait for the 5700A "U" annunciator to go out.

e. Wait 60 seconds for the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for +DC. Do not record a reading for the 5790A.

f. Set the 5700A to nominal negative, then turn the knob to obtain the error display reading you recorded in Table 3-3. Wait for the 5700A "U" annunciator to go out.

g. Again, allow the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for -DC. Do not record a reading for the 5790A.

h. Apply the nominal voltage at the frequency required for the calibration step. Wait for the "U" annunciator on the 5700A to go out.

i. Allow the DMM reading to stabilize. Record the DMM reading under the 792A column in the worksheet for AC. Do not record a reading for the 5790A.

j. Now do a computation to get measured ac using the formulas shown in the worksheet:

   1. Compute the average of the 792A dc readings as shown.
   2. Compute "AC MEAS" using the formula shown. Be sure to include the 792A correction as indicated in the formula. Use nominal dc in the formula.

k. Observe the default "EXACT VALUE" on the display. It shows the allowed number of decimal places for you to enter. Enter your computation of "AC MEAS" in the 5790A using the keypad, and press the [ENTER] key. After you press [ENTER], the Control Display shows the progress of the internal process of the calibration step.

NOTE

While a calibration step is in progress, inaccurate values may appear on the Measurement Display. This is normal. When the 5790A is finished with the step, the display will read accurately.

l. When the step has completed, set the 5700A to standby.

8. For an ac calibration point in the 2 mV through 20 mV group, you use a bootstrapping technique. This procedure assumes the you have calibrated the 60 mV points. Each range is bootstrapped from the next higher range as shown in Figure 3-9.

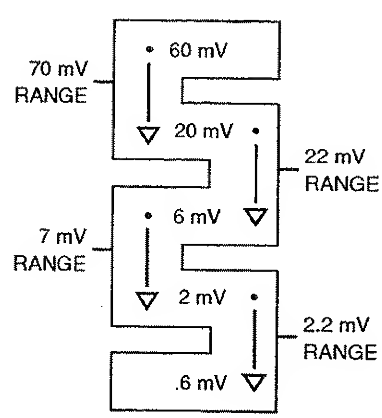


Figure 3-9. Millivolt Range Bootstrapping Technique

a. Calibrate the 22 mV range as follows:

1. Lock the 5790A in the 70 mV range. The 792A may be left attached, although it is not used.
2. Apply the requested voltage and frequency. When the reading on the 5790A Measurement Display settles, record the reading.
3. Press the "DO Step" softkey. This automatically selects the 22 mV range.
4. Enter the value you recorded in step 2 and press the ENTER softkey.
5. When the step has completed, set the 5700A to standby.
6. Repeat the previous steps 1 through 5 for the other 22 mV range point(s).

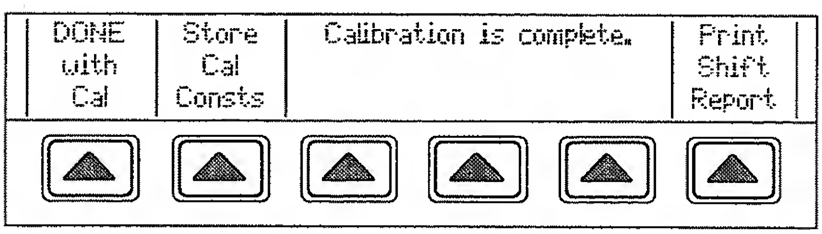
b. Calibrate the 7 mV range as follows:

1. Lock the 5790A in the 22 mV range. The 792A may be left attached, although it is not used.
2. Apply the requested voltage and frequency. When the reading on the 5790A Measurement Display settles, record the reading.
3. Press the "DO Step" softkey. This automatically selects the 7 mV range.
4. Enter the value you recorded in step 2 and press the ENTER softkey.
5. When the step has completed, set the 5700A to standby.
6. Repeat the previous steps 1 through 5 for the other 7 mV range point(s).

c. Calibrate the 2.2 mV range as follows:

1. Lock the 5790A in the 7 mV range. The 792A may be left attached, although it is not used.
2. Apply the requested voltage and frequency. When the reading on the 5790A Measurement Display settles, record the reading.
3. Press the "DO Step" softkey. This automatically selects the 2.2 mV range.
4. Enter the value you recorded in step 2 and press the ENTER softkey.
5. When the step has completed, set the 5700A to standby.
6. Repeat the previous steps 1 through 5 for the other 2.2 mV range point(s).

9. When you finish calibration, the display appears as follows:



10. Nothing has been saved in nonvolatile memory yet. To make calibration valid you need to store the constants. Set the rear panel CALIBRATION STORE switch to ENABLE. Press the "Store Cal Consts" softkey. Calibration is complete. For information about printing calibration reports, refer to Section 7 of the 5790A Operator Manual.
11. If you decide not to store the updated constants, press the "DONE with Cal" softkey. A menu warns you that if you quit at this point without storing the constants, the updated constants will be discarded. If you verify that you want to discard the constants, the 5790A copies the stored set of constants into the active

constants memory. Figure 3-1 illustrates how calibration constant groups are manipulated.

Calibrating the Wideband AC Option 3-18.

The following procedure is a part of periodic calibration only if a 5790A-03 Wideband Option is installed in your 5790A. If you are replacing or have repaired the Wideband assembly, perform the Wideband Amplifier Rolloff Adjustment, described in the Service Calibration part of this section, before calibration. You calibrate the WIDEBAND input in four major steps:

1. Perform the main input calibration first.
2. Characterize the ac source (a 5700A with Wideband option and associated attenuators, cable, and connectors).
3. Calibrate the WIDEBAND input gain.
4. Calibrate the WIDEBAND input flatness.

Table 3-7 lists the equipment required to calibrate the WIDEBAND input. Before you proceed, make a copy of Table 3-8, which is the worksheet for WIDEBAND input calibration.

CHARACTERIZING THE AC SOURCE 3-19.

To meet the test uncertainty requirements for WIDEBAND input calibration, you must first characterize the ac source to be used in the procedure. The attenuators must be characterized before use. You must characterize the source and calibrate the WIDEBAND input in a temperature-controlled room. The A55 Thermal Converter will not stabilize in a drafty or unstable environment. In this procedure you will fill in the 5700A ERROR column of Table 3-8 for later use during WIDEBAND flatness calibration.

NOTE

Fluke offers a calibration service for NARDA Model 777C attenuators at the Everett, Service Center. For price and delivery of this calibration service, please call the Everett Service Center at (206) 356-5560.

Table 3-7. Equipment Required for Wideband Calibration

EQUIPMENT	MANUFACTURER AND MODEL
Multifunction Calibrator	Fluke 5700A with Wideband Option
DMM	Fluke 8506A
Wideband RMS DVM	Fluke 8920A
Thermal Voltage Converter	Fluke A55 3V
20dB RF Attenuator (Qty. 3)	Narda 777C 20 (NOTE 1)
10dB RF Attenuator (Qty. 1)	Narda 777C 10 (NOTE 1)
RS-232 Video Display Terminal	Digital Equipment VT-100 (NOTE 2)
NOTE 1: The Narda attenuators must be characterized by Fluke (see text) NOTE 2: Required only for Service Calibration	

Table 3-8. Wideband Calibration Worksheet

				_______ RANGE					
FREQUENCY	A55 CORR. (PPM)	5790A ERROR (PPM)	5700A ERROR (PPM)	10 dB ERROR (PPM)	20 dB ERROR (PPM)	20 dB ERROR (PPM)	20 dB ERROR (PPM)	TOTAL ERROR (PPM)	1 kHz REF ERROR (ENTER ONCE)
10 Hz									
100 Hz									x
10 kHz									x
50 kHz									x
200 kHz									x
500 kHz									x
1 MHz									x
2 MHz									x
4 MHz									x
8 MHz									x
10 MHz									x
15 MHz									x
20 MHz									x
26 MHz									x
30 MHz									x

1. Connect the equipment as shown in Figure 3-10. Make sure that all connections are tight. The A55 must be loaded with 50Ω (by connecting it as shown in the figure) or it will be destroyed when the voltage is applied.
2. Make sure equipment warmup requirements are met.
3. Lock the 5790A on the 220 mV range.
4. Set the 5700A to output 3.2V at 1 kHz. The 5790A will read approximately 100 mV, and the 3V A55 output will be about 7 mV.
5. Allow the A55 to stabilize, then press the STORE and OFFSET keys on the 8506A DMM.
6. Press the "SET REF" softkey on the 5790A.
7. For each frequency in Table 3-8, set the 5700A frequency and perform steps 8, 9, and 10.
8. Apply any corrections for the response of the A55 TVC by first adjusting the 5700A output to bring the 8506A DMM offset reading to 0 ±3 counts, and then pressing the "NEW REF" key on the 5700A, and then further adjusting the 5700A to give the same error and sign as recorded on the A55 calibration sheet when it was calibrated. Also record the A55 correction in Table 3-8.
9. Record the error showing on the 5790A Control Display, including polarity, in Table 3-8.
10. Return to 3.2V, 1 kHz after each frequency calibrated to verify that the 8506A is still reading 0. Rezero the 8506A if necessary by pressing the OFFSET, STORE,

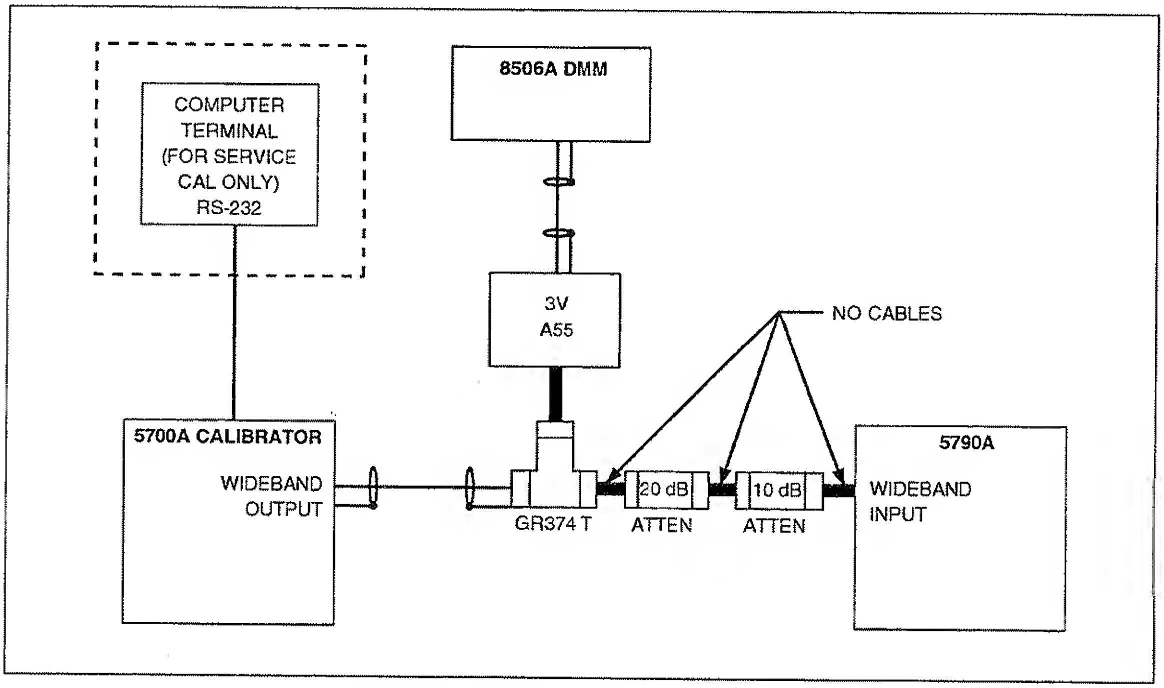


Figure 3-10. Wideband Calibration Source Characterization, Part 1

and OFFSET keys again. The 5790A display should read 0 ± 20 ppm. If it does not, press the "CLR REF WBND" softkey followed by "SET REF" softkey to rezero.

11. Set the 5700A to STANDBY.
12. Remove the DMM, A55, and the TEE, and connect the 5700A wideband cable to the attenuator input as shown in Figure 3-11.
13. Set the 5700A to 3.2V at 1 kHz and then press the "SET REF" softkey on the 5790A.
14. Proceed to each of the frequencies listed in Table 3-8, set the 5700A frequency, and adjust the 5700A to give the same error on the 5790A display as recorded in the table from the previous steps. Record the error displayed by the 5700A (both magnitude and sign) in Table 3-8 in PPM.
15. The 5700A is now characterized and can be used to calibrate the 5790A.

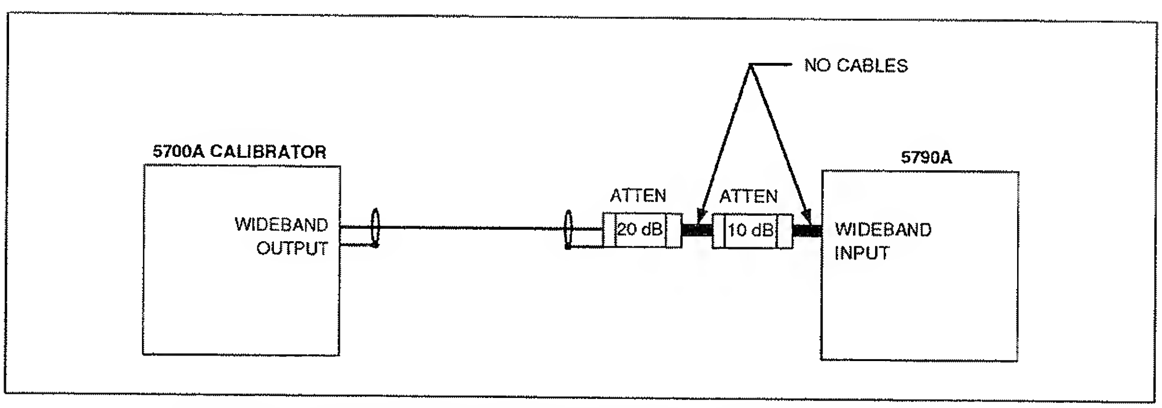
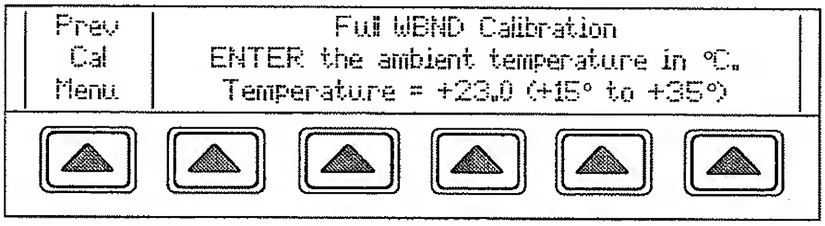


Figure 3-11. Wideband Calibration Source Characterization, Part 2

CALIBRATING WIDEBAND INPUT GAIN AT 1 kHz 3-20.

Proceed as follows to perform gain (absolute) calibration at 1 kHz for each range. You do not need the worksheet for this part of WIDEBAND calibration.

1. Connect the equipment as shown in Figure 3-12. Set the 8506A in the HI ACCUR mode.
2. Press the "UTIL MENUS" and then the "CAL" softkeys.
3. Press the "CAL" and then the "WBND CAL" softkeys. This produces the following display:



4. Enter the ambient temperature on the number keys and then press ENTER, or press ENTER to accept 23.0°C.
5. The 5790A will step to the first calibration point on the 7V range.
6. Apply 3.0V at 1 kHz and then press the "DO STEP" softkey.
7. Use the number keys to enter the value displayed on the 8506A DMM into the 5790A, then press [ENTER].
8. The 5790A will calibrate the 7V range and proceed to the 2.2V range.
9. Apply 2.0V at 1 kHz and press "DO STEP" as before.

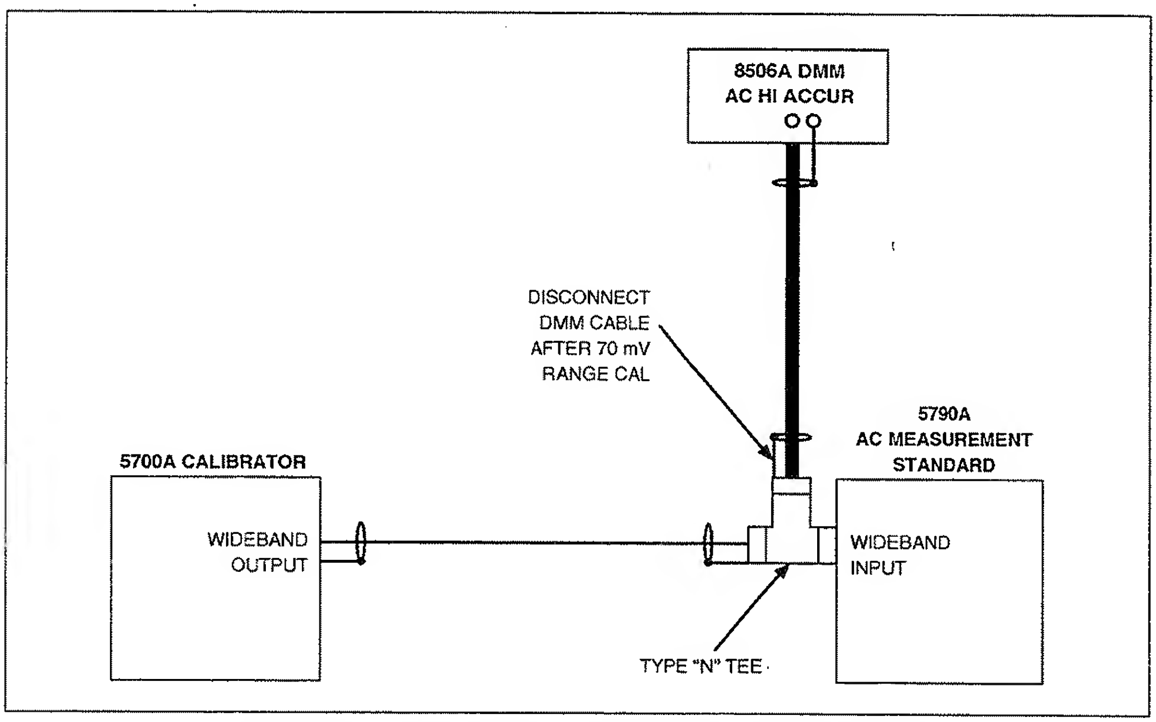


Figure 3-12. Gain Calibration Setup for 70 mV and Above

10. Enter the value from the 8506A into the 5790A as before and press [ENTER].
11. The 5790A will calibrate the 2.2V range and step to the 700 mV range.
12. The 700 mV, 220 mV, and 70 mV ranges are done in a similar way; just enter the exact value of the voltage as requested for each range and press [ENTER].
13. Disconnect the 8506A DMM after calibration of the 70 mV range. It is not accurate enough to calibrate the lower three ranges and it adds noise to the system.
14. If an accurate millivolt ac source is available, use it to calibrate the 22 mV, 7 mV, and 2.2 mV ranges in the same manner as the other ranges. Just enter the exact value when requested by the display and press [ENTER].
15. If an accurate millivolt source is not available, use a bootstrapping technique. Record the 5790A reading on the range above the one to be calibrated, and enter the recorded value as the "EXACT VALUE" when the display asks for it.
16. To calibrate the 22 mV range, connect the equipment as shown in Figure 3-11. Apply 20 mV at 1 kHz when the display asks for it. (The 5700A will need to be set to about 600 mV due to the 30 dB of attenuation.)
17. Press the 70 mV range key and measure and record the value.
18. Press the "DO STEP" softkey and enter the number just measured on the 70 mV range. Now press the [ENTER] key and the 5790A will calibrate the 22 mV range and step to the 7 mV calibration display.
19. Calibrate the 7 mV range by applying 6 mV at 1 kHz and then pressing the 22 mV range key to measure and record the value. Press the "DO STEP" softkey and enter the value just measured on the 22 mV range. Press the [ENTER] key and the 5790A will calibrate the 7 mV range and step to the 2.2 mV calibration display.
20. The 2.2 mV range is done in a similar manner by reading the value on the 7 mV range and entering the value when requested and then pressing the [ENTER] key.
21. The absolute calibration on all ranges is now complete and the 5790A is ready for flatness calibration.

CALIBRATING WIDEBAND INPUT FLATNESS 3-21.

Wideband source characterization must be done within 30 minutes of beginning flatness calibration. Before you begin, make 8 copies of Table 3-8 with the 5700A error column filled in. (You recorded entries into the 5700A error column during in the first part of WIDEBAND calibration.)

1. Connect the equipment as shown in Figure 3-13.

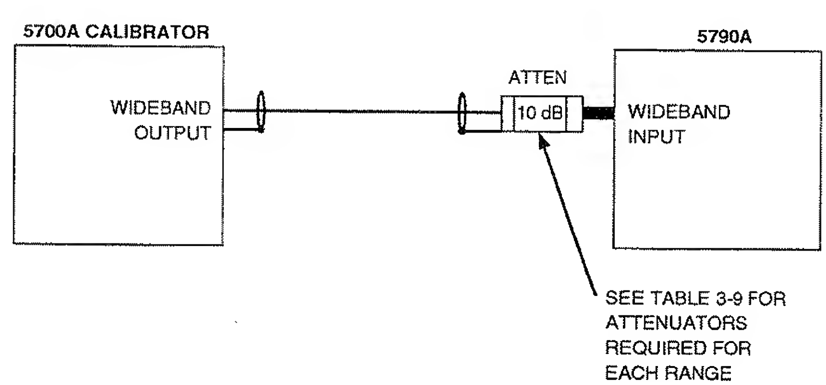


Figure 3-13. WIDEBAND Input Flatness Calibration Test Setup

2. The 5700A will be set to a nominal 3.2V for all flatness calibration. The only deviation from the nominal value will be for calibration corrections for the 5700A and the attenuators.
3. Enter a range voltage at the top of each copy you made of Table 3-8 (7V, 2.2V, 700 mV, 220 mV, 70 mV, 22 mV, 7 mV, and 2.2 mV). Also enter the attenuator corrections as required for each range. Add the total error for each frequency and enter the result in the TOTAL ERROR column in each copy. The total error equals the sum of errors of the 5700A and all attenuators used for that frequency. Table 3-9 shows the combination of attenuators required to scale the input signal properly for each range.
4. All ranges are calibrated in a similar manner. The calibration program will prompt you at each step as to what frequency to apply.
5. The flatness calibration program starts with the 7V range at a frequency of 10 Hz.
6. To establish a 1-kHz reference at the beginning of each range, set the 5700A to 3.2V and 1 kHz, and set the 5790A to the 7V range in this case. The 5790A will measure the magnitude. Record this value in Table 3-8.
7. Press the "DO STEP" softkey and enter the 1-kHz reference value just measured for the "APPLIED VALUE".
8. Set the 5700A to 3.2V 10 Hz and adjust the 5700A to the total error value at 10 Hz that was recorded in Table 3-8 during source characterization.
9. Press the [ENTER] key and the system will calibrate the range at 10 Hz and step to the 100-Hz calibration point.
10. Set the 5700A to 100 Hz and adjust the 5700A to the total error value at 100 Hz that was recorded in Table 3-8 during source characterization.
11. Press the "DO STEP" and "LAST ENTRY" keys to enter the current "APPLIED VALUE".
12. Press the [ENTER] key and the system will calibrate the range at 100 Hz and step to the 10-kHz calibration point.
13. Proceed through the range at each calibration point frequency in the same manner as steps 10, 11, and 12 by applying the proper frequency and total error values. (Note that the total error value is the sum of the errors of the 5700A and all attenuators used for that range and frequency.)

Table 3-9. Attenuators Required for Each Range

RANGE	ATTENUATORS	5790A INPUT
7V	None	3.2V
2.2V	(1) 10 dB	1V
700 mV	(1) 20 dB	320 mV
220 mV	(1) 20 dB + (1) 10 dB	100 mV
70 mV	(2) 20 dB	32 mV
22 mV	(2) 20 dB + (1) 10 dB	10 mV
7 mV	(3) 20 dB	3.2 mV
2.2 mV	(3) 20 dB + (1) 10 dB	1 mV

14. When the calibration program has completed all steps in the 7V range it will step to the beginning of the 2.2V range at 10 Hz.
15. Install the 10-dB attenuator as required by Table 3-9 for the 2.2V range.
16. Establish the 1-kHz reference for this range by again setting the 5700A to 3.2V at 1 kHz and the 5790A to the 2.2V range. The 5790A will measure the magnitude. Record this value in Table 3-8.
17. Press the "DO STEP" softkey and enter the 1-kHz reference value just measured for the "APPLIED VALUE".
18. Set the 5700A to 3.2V 10 Hz and adjust the 5700A to the total error value at 10 Hz for the 2.2V range as recorded in Table 3-8.
19. Press the [ENTER] key and the system will calibrate the range at 10 Hz and step to the 100-Hz calibration point as before.
20. Set the 5700A to 100 Hz and adjust for errors, press "LAST ENTRY," then press [ENTER] as before.
21. The system will calibrate the 100 Hz point and step to the 10 kHz point.
22. Proceed through the range at each calibration point as before by applying the proper frequency and error values.
23. All remaining ranges are done in a similar manner by installing the proper attenuators, establishing the 1-kHz reference and adjusting for errors at each frequency.
24. When all ranges are calibrated, store the calibration constants to complete the calibration procedure. The rear panel CALIBRATION STORE switch must be in the ENABLE position to store the calibration constants. Return the switch to the NORMAL position after the constants are stored.

SERVICE CALIBRATION 3-22.

Service calibration is a more complete calibration that should be done only after repair or replacement of an analog module. Service calibration is the procedure done at the factory when the 5790A is built. (However, Fluke uses an automated calibration system.)

Use the same procedure as for periodic calibration, as previously defined, except set the rear panel CALIBRATION MODE switch to SERVICE and the CALIBRATION STORE switch to ENABLE. This switch setting generates prompts that request many more stimuli points than used in periodic calibration, plus the "Xfer Offset Adjustment" and the "Wideband Amplifier Rolloff Adjustment" (the latter only if a Wideband Option is installed). Table 3-10 lists the main input calibration steps called for in service calibration. (WIDEBAND Service Calibration uses the same steps as Periodic Calibration.) Note that the "I2/I1" steps, at the beginning of ac calibration have only a 1% absolute tolerance, but a very tight drift requirement.

Xfer Offset Adjustment 3-23.

If you repaired or replaced the Transfer assembly, adjust the millivolt-range amplifier offset for zero as follows:

1. Turn off the power and unplug the 5790A.
2. Remove the eight flat-head machine screws from the top cover and remove the top cover.

Table 3-10. Calibration Steps in Service Calibration

STEP NAME	VOLTAGE TO APPLY	TOLERANCE OF CALIBRATION SOURCE (± PPM)	PURPOSE OF CALIBRATION STEP
Basic DC	+2V dc	3	Calibrates DACs and thermal sensor. (This is the unscaled range.)
Sensor turnover -2.0	-2V dc	3	Corrects dc turnover error
Sensor turnover +0.7 Sensor turnover -0.7	+0.7V dc -0.7V dc	5	Corrects turnover error of the rms sensor at minimum scale. After the -0.7V step, internally calibrates the range zeros.
1000V Positive DC 1000V Negative DC	+1000V dc -1000V dc	3	Establishes gain and dc offset for the 1000V range
700V Positive DC 700V Negative DC	+600V dc -600V dc	3	Establishes gain and dc offset for the 700V range
220V Positive DC 220V Negative DC	+200V dc -200V dc	3	Establishes gain and dc offset for the 220V range
70V Positive DC 70V Negative DC	+60V dc -60V dc	3	Establishes gain and dc offset for the 70V range
22V Positive DC 22V Negative DC	+20V dc -20V dc	3	Establishes gain and dc offset for the 22V range
7V Positive DC 7V Negative DC	+6V dc -6V dc	3	Establishes gain and dc offset for the 7V range
2.2V Positive DC 2.2V Negative DC	+2V dc -2V dc	3	Establishes gain and dc offset for the 2.2V range
700 mV Positive DC 700 mV Negative DC	+600 mV dc -600 mV dc	5	Establishes gain and dc offset for the 700 mV range
220 mV Positive DC 220 mV Negative DC	+200 mV dc -200 mV dc	10	Establishes gain and dc offset for the 220 mV range
70 mV Positive DC 70 mV Negative DC	+60 mV dc -60 mV dc	35	Establishes gain and dc offset for the 70 mV range
22 mV Positive DC 22 mV Negative DC	+20 mV dc -20 mV dc	100	Establishes gain and dc offset for the 22 mV range
7 mV Positive DC 7 mV Negative DC	+6 mV dc -6 mV dc	350	Establishes gain and dc offset for the 7 mV range
2.2 mV Positive DC 2.2 mV Negative DC	+2 mV dc -2 mV dc	1000	Establishes gain and dc offset for the 2.2 mV range
700V I2/I1 100 kHz (Input 1)	219V rms, 100 kHz	1%, and 1-minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the 1 kV divider

Table 3-10. Calibration Steps in Service Calibration (cont)

STEP NAME	VOLTAGE TO APPLY	TOLERANCE OF CALIBRATION SOURCE (± PPM)	PURPOSE OF CALIBRATION STEP
700V I2/I1 100 kHz (Input 2)	219V rms, 100 kHz	1%, and 1-minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the 1 kV divider
22V I2/I1 1 MHz (Input 1)	20V rms, 1 MHz	1%, and 1-minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the 220V divider
22V I2/I1 1 MHz (Input 2)	20V rms, 1 MHz	1%, and 1-minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the 220V divider
2.2V I2/I1 1 MHz (Input 1)	2.0V rms, 1 MHz	1%, and 1-minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the protection circuit
2.2V I2/I1 1 MHz (Input 2)	2.0V rms, 1 MHz	1%, and 1-minute stability better than 50 ppm	Calibrates the relative frequency response of INPUT 1 and INPUT 2 through the protection circuit
LF (10 Hz) Linearity LF (10 Hz) Linearity	2V rms, 10 Hz 0.6V rms, 10 Hz	190	Generates a correction for thermal sensor non-linearity at low V and f
1 kV AC 1 kHz 1 kV AC 20 kHz 1000V AC 100 kHz	1000V rms, 1 kHz 1000V rms, 20 kHz 1000V rms, 100 kHz	25 27 70	Generates flatness calibration data for the 1000V range
700V AC 1 kHz 700V AC 20 kHz 700V AC 100 kHz	600V rms, 1 kHz 600V rms, 20 kHz 200V rms, 100 kHz	27 30 70	Generates flatness calibration data for the 1000V range
220V AC 1 kHz 220V AC 20 kHz 220V AC 300 kHz	200V rms, 1 kHz 200V rms, 20 kHz 60V rms, 300 kHz	18 18 130	Generates flatness calibration data for the 220V range
70V AC 1 kHz 70V AC 20 kHz 70V AC 500 kHz 70V AC 1 MHz	60V rms, 1 kHz 60V rms, 20 kHz 20V rms, 500 kHz 20V rms, 1 MHz	20 20 125 125	Generates flatness calibration data for the 70V range
22V AC 1 kHz 22V AC 20 kHz 22V AC 100 kHz 22V AC 300 kHz 22V AC 500 kHz 22V AC 1 MHz	20V rms, 1 kHz 20V rms, 20 kHz 20V rms, 100 kHz 20V rms, 300 kHz 20V rms, 500 kHz 20V rms, 1 MHz	15 15 50 120 125 125	Generates flatness calibration data for the 22V range

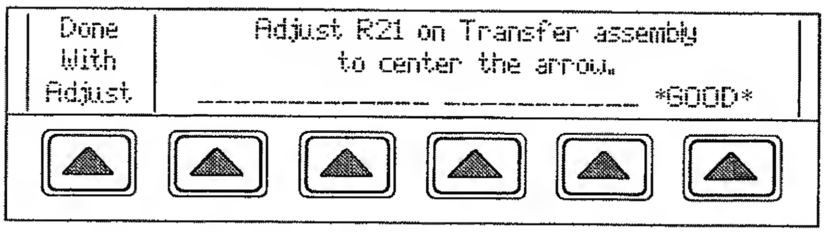
Table 3-10. Calibration Steps in Service Calibration (cont)

STEP NAME	VOLTAGE TO APPLY	TOLERANCE OF CALIBRATION SOURCE (± PPM)	PURPOSE OF CALIBRATION STEP
7V AC 1 kHz	6V rms, 1 kHz	10	Generates flatness calibration data for the 7V range
7V AC 20 kHz	6V rms, 20 kHz	10	
7V AC 100 kHz	6V rms, 100 kHz	50	
7V AC 300 kHz	6V rms, 300 kHz	120	
7V AC 500 kHz	6V rms, 500 kHz	125	
7V AC 800 kHz	6V rms, 800 kHz	125	
7V AC 1 MHz	6V rms, 1 MHz	125	
2.2V AC 10 Hz	2V rms, 10 Hz	190	Generates flatness calibration data for the 2.2V range
2.2V AC 1 kHz	2V rms, 1 kHz	10	
2.2V AC 20 kHz	2V rms, 20 kHz	10	
2.2V AC 300 kHz	2V rms, 300 kHz	115	
2.2V AC 1 MHz	2V rms, 1 MHz	125	
700 mV AC 10 Hz	600 mV rms, 10 Hz	200	Generates flatness calibration data for the 700 mV range
700 mV AC 1 kHz	600 mV rms, 1 kHz	22	
700 mV AC 20 kHz	600 mV rms, 20 kHz	22	
700 mV AC 300 kHz	600 mV rms, 300 kHz	130	
700 mV AC 1 MHz	600 mV rms, 1 MHz	140	
220 mV AC 10 Hz	200 mV rms, 10 Hz	200	Generates flatness calibration data for the 220 mV range
220 mV AC 1 kHz	200 mV rms, 1 kHz	30	
220 mV AC 20 kHz	200 mV rms, 20 kHz	30	
220 mV AC 300 kHz	200 mV rms, 300 kHz	220	
220 mV AC 1 MHz	200 mV rms, 1 MHz	300	
70 mV AC 10 Hz	60 mV rms, 10 Hz	230	Generates flatness calibration data for the 60 mV range
70 mV AC 1 kHz	60 mV rms, 1 kHz	60	
70 mV AC 20 kHz	60 mV rms, 20 kHz	60	
70 mV AC 300 kHz	60 mV rms, 300 kHz	500	
70 mV AC 1 MHz	60 mV rms, 1 MHz	600	
22 mV AC 10 Hz	20 mV rms, 10 Hz	280*	Generates flatness calibration data for the 22 mV range
22 mV AC 1 kHz	20 mV rms, 1 kHz	100*	
22 mV AC 20 kHz	20 mV rms, 20 kHz	100*	
22 mV AC 300 kHz	20 mV rms, 300 kHz	720*	
22 mV AC 500 kHz	20 mV rms, 500 kHz	720*	
22 mV AC 1 MHz	20 mV rms, 1 MHz	720*	

Table 3-10. Calibration Steps in Service Calibration (cont)

STEP NAME	VOLTAGE TO APPLY	TOLERANCE OF CALIBRATION SOURCE (± PPM)	PURPOSE OF CALIBRATION STEP
7 mV AC 10 Hz	6 mV rms, 10 Hz	840*	Generates flatness calibration data for the 7 mV range
7 mV AC 1 kHz	6 mV rms, 1 kHz	200*	
7 mV AC 20 kHz	6 mV rms, 20 kHz	200*	
7 mV AC 300 kHz	6 mV rms, 300 kHz	1200*	
7 mV AC 500 kHz	6 mV rms, 500 kHz	1200*	
7 mV AC 800 kHz	6 mV rms, 800 kHz	1200*	
7 mV AC 1 MHz	6 mV rms, 1 MHz	1200*	
2.2 mV AC 10 Hz	2 mV rms, 10 Hz	1700*	Generates flatness calibration data for the 2.2 mV range
2.2 mV AC 1 kHz	2 mV rms, 1 kHz	400*	
2.2 mV AC 20 kHz	2 mV rms, 20 kHz	400*	
2.2 mV AC 300 kHz	2 mV rms, 300 kHz	2300*	
2.2 mV AC 500 kHz	2 mV rms, 500 kHz	2300*	
2.2 mV AC 800 kHz	2 mV rms, 800 kHz	2300*	
2.2 mV AC 1 MHz	2 mV rms, 1 MHz	2300*	
*These uncertianties can be achieved using the "bootstrap" techniques described in the ac calibration procedure			

3. Locate the access hole for potentiometer R27 on the guard cover as shown in Figure 3-14.
4. Set the CALIBRATION MODE switch to SERVICE.
5. Set the CALIBRATION STORE switch to ENABLE.
6. Turn on the 5790A power and allow 30 minutes for warmup.
7. Press the [UTIL MENUS] key followed by the "Cal" softkey. Press the "Service Cal" and "Xfer Offset Adjust" softkeys. The Control Display changes to:



8. Adjust R27 if necessary to center the pointer. Note the reading on the Measurement Display. It shows the offset in mV. Try to obtain as close to a zero reading.
9. Press "Done With Adjust" and replace the top cover.

Wideband Amplifier Rolloff Adjustment 3-24.

If you repaired or replaced the A6 Wideband assembly, adjust the amplifier rolloff as follows:

1. Turn off power and unplug the 5790A.
2. Remove the top cover.
3. Remove the guard cover.

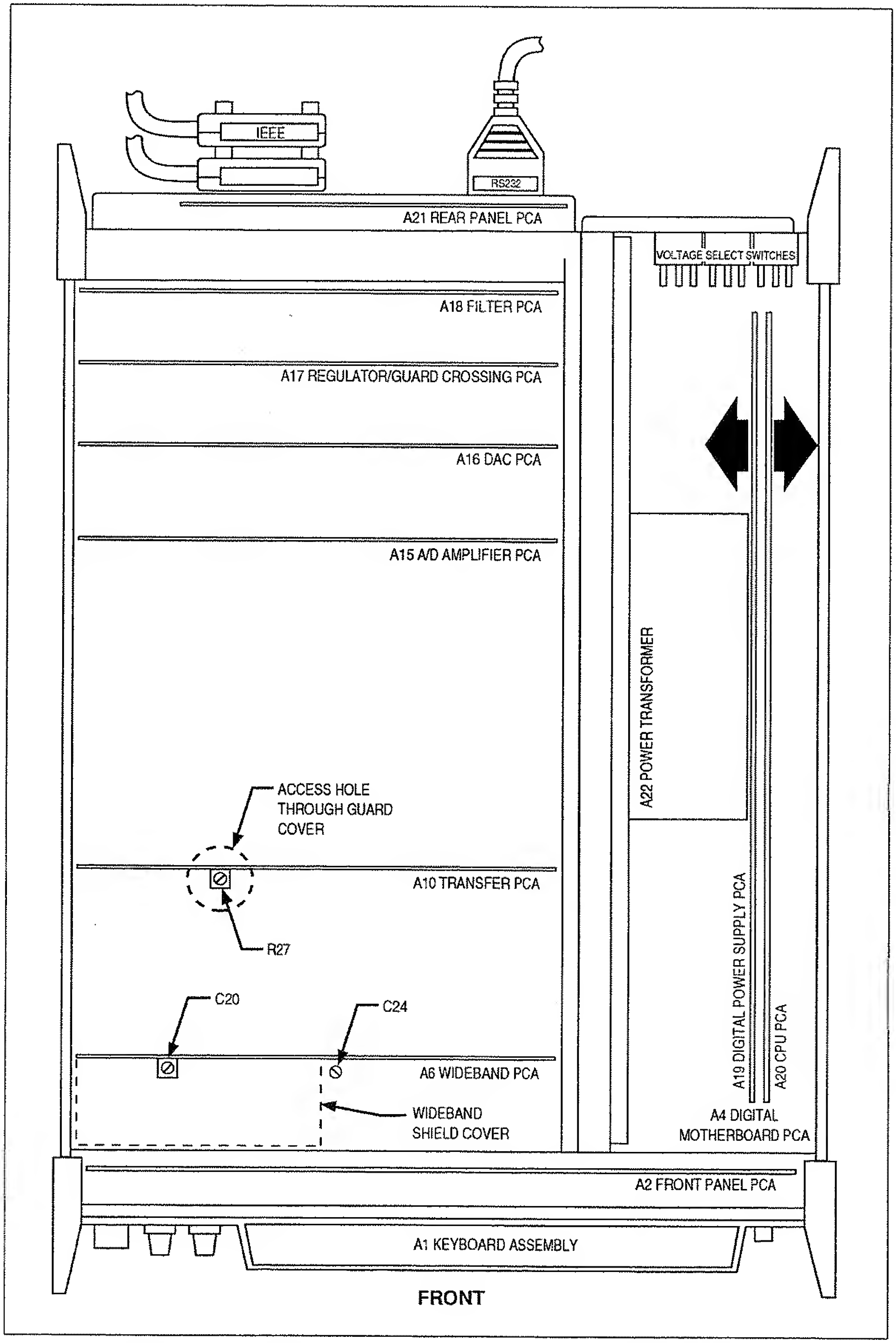


Figure 3-14. Location of R27 (Transfer), and C20 and C24 (Wideband)

4. Referring to Figure 3-14, locate trimmer caps C24 and C20. C20 is accessed through a hole in the top of the small shield cover.
5. Replace the guard cover, but do not reinstall the screws.
6. Turn on the 5790A and allow 30 minutes for warmup.
7. Set up the equipment as shown in Figure 3-10, including the RS-232 video display terminal.
8. Set up the terminal and the 5790A serial interface parameters. Use the TERMINAL mode rather than COMPUTER. Section 7 of the 5790A Operator Manual describes how to do this.
9. Type the following commands on the terminal followed by the Return key:

```
CAL_CONST? F16_220MV_WB
CAL_CONST? F16_70MV_WB
```

10. Enter the results in Table 3-11. Use only the first 6 digits to the right of the decimal point. Make the calculations shown in the table for use in steps 16 and 26.
11. Set the 5790A to WBND and the 220 mV range.
12. Set the 5700A to 3.2V at 1 kHz, operate. The 5790A will read approximately 100 mV.
13. Allow the A55 to stablize, and then press the STORE and OFFSET keys on the the 8506A DMM.
14. Press the "SET REF" softkey on the 5790A.
15. Set the 5700A to 30 MHz, and adjust the 5700A to bring the 8506A reading to 0.
16. Press the [NEW REF] button on the 5700A and dial in the 30-MHz correction for the A55, the attenuators, and the current active calibration constant. You do this by adjusting the 5700A knob for a 5700A error display of the same sign and magnitude as the total error entry 220 mV range at the bottom of Table 3-11.
17. Raise the front of the guard cover and adjust C24 for a 5790A display of -3500 PPM ±1000 PPM. (Use a Johanson #8777 tool or equivalent).
18. Set the 5700A to standby.
19. Replace the 10-dB attenuator with a 20-dB attenuator to give a total attenuation of 40 dB.
20. Set the 5790A to the 70 mV range.
21. Set the 5700A to 3.2V at 1 kHz, operate.

Table 3-11. Wideband Amplifier Rolloff Adjustment Worksheet

ROLLOFF WORKSHEET ENTRY	220 mV RANGE	70 mV RANGE
30 MHz CAL CONSTANT NAME	F16_220MV_WB	F16_70MV_WB
ACTIVE VALUE		
DEFAULT		
(1) ACTIVE - DEFAULT (PPM)		
(2) A55 CORRECTION (PPM)		
(3) ATTENUATOR #1 ERROR (PPM)		
(4) ATTENUATOR #2 ERROR (PPM)		
TOTAL 1 + 2 + 3 + 4 (PPM)		

22. The 5790A will read approximately 32 mV.
23. Allow the A55 to stabilize, and then press the STORE and OFFSET buttons on the 8506A DMM.
24. Press the "SET REF" softkey on the 5790A.
25. Set the 5700A to 30 MHz, and adjust the 5700A to bring the 8506A reading ot 0.
26. Press the [NEW REF] button on the 5700A and dial in the 30-MHz correction for the A55, the attenuators, and the current active calibration constant. You do this by adjusting the 5700A knob for a 5700A error display of the same sign and magnitude as the total error entry 70 mV range at the bottom of Table 3-11.
27. Raise the front of the guard cover and adjust C20 for -3500 PPM ±1000 PPM.
28. Set the 5700A to standby and remove the A55 and attenuators.
29. Replace the covers and screws.

VERIFICATION 3-25.

An independent external verification is recommended every two years, or after repair of the 5790A. Verification establishes and maintains external traceability paths parallel to calibration, and confirms that internal calibration processes are in control. Main input verification is presented first, followed by WIDEBAND input verification.

NOTE

All performance limits specified in the test records apply to 90-day specifications for the 5790A. For Wideband verification, the 2-year or 1-year specifications are used where there are no 90-day specifications. If limits to other specifications are desired, the test records must be modified.

NOTE

Equivalent equipment and methods, either manual or automated, may be substituted for the following verification tests as long as the same points are tested, and equipment and standards used are at least as accurate as those specified. If standards are less accurate than specified, appropriate tolerance limit and/or accuracy reductions must be made to achieve equivalent results.

Verifying the Main Input (INPUT 1 or 2) 3-26.

Verifying the Main Input requires measurements and calculations that result in over 400 entries in a test record. At Fluke, an automated procedure is used as described in the introduction to this section. Test voltages and frequencies are divided into five regions as defined in Table 3-12. The procedures you use for each region are described next.

To do the procedure manually, make copies of the rest of the worksheets in this section before you proceed. Table 3-13 is the overall test record for main input verification.

Table 3-12. Main Input Verification Regions

RANGES	AC-DC DIFFERENCE ERROR	ABSOLUTE AC ERROR
2.2V through 1000V	Region I	Region II
70 mV through 700 mV	Region III	Region IV
7 mV through 22 mV	No spec	Region V

Table 3-13. Main Input Verification Test Record

STEP NO.	5790A RANGE	TEST VOLTAGE (V)	FREQUENCY	AC SOURCE MAXIMUM UNCERTAINTY (NOTE)	90-DAY ABSOLUTE AC ERROR SPEC (± PPM)	1 YEAR ABSOLUTE AC ERROR SPEC (+- PPM)	MEASURED ABSOLUTE AC ERROR (PPM)	2-YR AC-DC ERROR SPEC (± PPM)	MEASURED AC-DC ERROR (PPM)
1	0.0022	0.002	10 Hz	1700*	2350	2350		No spec	
2	0.0022	0.002	20 Hz	700*	1390	1390		No spec	
3	0.0022	0.002	100 Hz	400*	1070	1070		No spec	
4	0.0022	0.002	1 kHz	400*	1070	1070		No spec	
5	0.0022	0.002	10 kHz	400*	1070	1070		No spec	
6	0.0022	0.002	20 kHz	400*	1070	1070		No spec	
7	0.0022	0.002	50 kHz	800*	1810	1810		No spec	
8	0.0022	0.002	100 kHz	1200*	2450	2450		No spec	
9	0.0022	0.002	300 kHz	2300*	4300	4300		No spec	
10	0.0022	0.002	500 kHz	2300*	5400	6400		No spec	
11	0.0022	0.002	1 MHz	2300*	6200	7500		No spec	
12	0.007	0.006	10 Hz	840*	1070	1070		No spec	
13	0.007	0.006	20 Hz	360*	587	587		No spec	
14	0.007	0.006	100 Hz	200*	427	427		No spec	
15	0.007	0.006	1 kHz	200*	427	427		No spec	
16	0.007	0.006	10 kHz	200*	427	427		No spec	
17	0.007	0.006	20 kHz	200*	427	427		No spec	
18	0.007	0.006	50 kHz	400*	733	733		No spec	
19	0.007	0.006	100 kHz	600*	1020	1020		No spec	
20	0.007	0.006	300 kHz	1200*	1870	1870		No spec	
21	0.007	0.006	500 kHz	1200*	2300	2600		No spec	
22	0.007	0.006	1 MHz	1200*	3000	3600		No spec	

Table 3-13. Main Input Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE (V)	FREQUENCY	AC SOURCE MAXIMUM UNCERTAINTY (NOTE)	90-DAY ABSOLUTE AC ERROR SPEC (± PPM)	1 YEAR ABSOLUTE AC ERROR SPEC (+- PPM)	MEASURED ABSOLUTE AC ERROR (PPM)	2-YR AC-DC ERROR SPEC (± PPM)	MEASURED AC-DC ERROR (PPM)
23	0.022	0.02	10 Hz	280*	355	355		No spec	
24	0.022	0.02	20 Hz	180*	245	245		No spec	
25	0.022	0.02	100 Hz	100*	175	175		No spec	
26	0.022	0.02	1 kHz	100*	175	175		No spec	
27	0.022	0.02	10 kHz	100*	175	175		No spec	
28	0.022	0.02	20 kHz	100*	175	175		No spec	
29	0.022	0.02	50 kHz	200*	310	310		No spec	
30	0.022	0.02	100 kHz	300*	435	435		No spec	
31	0.022	0.02	300 kHz	720*	1010	1010		No spec	
32	0.022	0.02	500 kHz	720*	1160	1290		No spec	
33	0.022	0.02	1 MHz	720*	1700	2100		No spec	
34	0.07	0.06	10 Hz	230	265	265		No spec	
35	0.07	0.06	20 Hz	120	145	145		No spec	
36	0.07	0.06	100 Hz	60	89	90		No spec	
37	0.07	0.06	1 kHz	60	89	90		No spec	
38	0.07	0.06	10 kHz	60	89	90		No spec	
39	0.07	0.06	20 kHz	60	89	90		No spec	
40	0.07	0.06	50 kHz	120	153	163		No spec	
41	0.07	0.06	100 kHz	250	302	302		No spec	
42	0.07	0.06	300 kHz	500	577	577		No spec	
43	0.07	0.06	500 kHz	600	760	803		No spec	
44	0.07	0.06	1 MHz	600	1200	1230		No spec	

Table 3-13. Main Input Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE (V)	FREQUENCY	AC SOURCE MAXIMUM UNCERTAINTY (NOTE)	90-DAY ABSOLUTE AC ERROR SPEC (± PPM)	1 YEAR ABSOLUTE AC ERROR SPEC (+- PPM)	MEASURED ABSOLUTE AC ERROR (PPM)	2-YR AC-DC ERROR SPEC (± PPM)	MEASURED AC-DC ERROR (PPM)
45	0.22	0.2	10 Hz	200	218	218		210	
46	0.22	0.2	20 Hz	80	92	93		82	
47	0.22	0.2	100 Hz	30	45	46		34	
48	0.22	0.2	1 kHz	30	45	46		34	
49	0.22	0.2	10 kHz	30	45	46		34	
50	0.22	0.2	20 kHz	30	45	46		34	
51	0.22	0.2	50 kHz	65	79	79		67	
52	0.22	0.2	300 kHz	220	260	270		No spec	
53	0.22	0.2	500 kHz	250	390	420		No spec	
54	0.22	0.2	1 MHz	300	970	1040		No spec	
55	0.7	0.6	10 Hz	200	213	213		210	
56	0.7	0.6	20 Hz	70	78	79		73	
57	0.7	0.6	100 Hz	22	34	36		27	
58	0.7	0.6	1 kHz	22	34	36		27	
59	0.7	0.6	10 kHz	22	34	36		27	
60	0.7	0.6	20 kHz	22	34	36		27	
61	0.7	0.6	50 kHz	45	53	54		47	
62	0.7	0.6	100 kHz	60	83	83		No spec	
63	0.7	0.6	300 kHz	130	167	187		No spec	
64	0.7	0.6	500 kHz	140	310	313		No spec	
65	0.7	0.6	1 MHz	140	910	973		No spec	
66	2.2	2.0	10 Hz	190	200	200		200	

Table 3-13. Main Input Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE (V)	FREQUENCY	AC SOURCE MAXIMUM UNCERTAINTY (NOTE)	90-DAY ABSOLUTE AC ERROR SPEC (± PPM)	1 YEAR ABSOLUTE AC ERROR SPEC (+- PPM)	MEASURED ABSOLUTE AC ERROR (PPM)	2-YR AC-DC ERROR SPEC (± PPM)	MEASURED AC-DC ERROR (PPM)
67	2.2	2.0	20 Hz	60	65	66		63	
68	2.2	2.0	100 Hz	10	22	24		18	
69	2.2	2.0	1 kHz	10	22	24		18	
70	2.2	2.0	10 kHz	10	22	24		18	
71	2.2	2.0	20 kHz	10	22	24		18	
72	2.2	2.0	50 kHz	40	45	46		43	
73	2.2	2.0	100 kHz	50	70	71		No spec	
74	2.2	2.0	300 kHz	115	150	160		No spec	
75	2.2	2.0	500 kHz	125	250	260		No spec	
76	2.2	2.0	1 MHz	125	840	900		No spec	
77	7.0	6.0	10 Hz	190	200	200		200	
78	7.0	6.0	20 Hz	60	66	67		63	
79	7.0	6.0	100 Hz	10	22	24		18	
80	7.0	6.0	1 kHz	10	22	24		18	
81	7.0	6.0	10 kHz	10	22	24		18	
82	7.0	6.0	20 kHz	10	22	24		18	
83	7.0	6.0	50 kHz	40	46	48		44	
84	7.0	6.0	100 kHz	50	80	81		No spec	
85	7.0	6.0	300 kHz	120	180	190		No spec	
86	7.0	6.0	500 kHz	125	380	400		No spec	
87	7.0	6.0	1 MHz	125	1100	1200		No spec	
88	22	20.0	10 Hz	190	200	200		123	

Table 3-13. Main Input Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE (V)	FREQUENCY	AC SOURCE MAXIMUM UNCERTAINTY (NOTE)	90-DAY ABSOLUTE AC ERROR SPEC (± PPM)	1 YEAR ABSOLUTE AC ERROR SPEC (+- PPM)	MEASURED ABSOLUTE AC ERROR (PPM)	2-YR AC-DC ERROR SPEC (± PPM)	MEASURED AC-DC ERROR (PPM)
89	22	20.0	20 Hz	60	66	67		123	
90	22	20.0	100 Hz	15	25	27		21	
91	22	20.0	1 kHz	15	25	27		21	
92	22	20.0	10 kHz	15	25	27		21	
93	22	20.0	20 kHz	15	25	27		21	
94	22	20.0	50 kHz	40	46	48		44	
95	22	20.0	100 kHz	50	80	81		No spec	
96	22	20.0	300 kHz	120	180	190		No spec	
97	22	20.0	500 kHz	125	380	400		No spec	
98	22	20.0	1 MHz	125	1100	1200		No spec	
99	70	60.0	10 Hz	190	200	200		200	
100	70	60.0	20 Hz	60	67	68		63	
101	70	60.0	100 Hz	20	30	32		25	
102	70	60.0	1 kHz	20	30	32		25	
103	70	60.0	10 kHz	20	30	32		25	
104	70	60.0	20 kHz	20	30	32		25	
1085	70	60.0	50 kHz	50	56	57		55	
106	70	60.0	100 kHz	65	91	94		No spec	
107	70	60.0	300 kHz	130	190	200		No spec	
108	220	200.0	10 Hz	190	200	200		200	
109	220	200.0	20 Hz	60	67	68		63	
110	220	200.0	100 Hz	18	29	31		23	

Table 3-13. Main Input Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE (V)	FREQUENCY	AC SOURCE MAXIMUM UNCERTAINTY (NOTE)	90-DAY ABSOLUTE AC ERROR SPEC (± PPM)	1 YEAR ABSOLUTE AC ERROR SPEC (+- PPM)	MEASURED ABSOLUTE AC ERROR (PPM)	2-YR AC-DC ERROR SPEC (± PPM)	MEASURED AC-DC ERROR (PPM)
111	220	200.0	1 kHz	18	29	31		23	
112	220	200.0	10 kHz	18	29	31		23	
113	220	200.0	20 kHz	18	29	31		23	
114	220	200.0	50 kHz	60	67	69		63	
115	220	200.0	100 kHz	70	96	98		No spec	
116	700	600.0	100 Hz	27	39	41		36	
200	700	600.0	1 kHz	27	39	41		36	
201	700	600.0	10 kHz	30	39	41		36	
202	700	600.0	20 kHz	30	39	41		36	
203	700	600.0	50 kHz	60	120	130		No spec	
204	700	600.0	100 kHz	70	400	500		No spec	
205	1000	1000.0	100 Hz	25	37	38		33	
206	1000	1000.0	1 kHz	25	37	38		33	
207	1000	1000.0	10 kHz	27	37	38		33	
208	1000	1000.0	20 kHz	27	37	38		33	
209	1000	600.0	50 kHz	60	120	130		No spec	
210	1000	600.0	100 kHz	70	400	500		No spec	

* The AC source maximum uncertainity can be met by measuring down scale on the next higher range of the 5790 as desribed in the procedure.

VERIFYING AC-DC DIFFERENCE FOR REGIONS I AND III (220 mV THROUGH 1000V RANGE) 3-27.

You calculate the ac-dc difference error by comparing the ac-dc difference of the source as measured by the 5790A and the 792A. To do this, use the instrument setup and technique as described under "AC Calibration".

Proceed as follows to verify ac-dc difference in regions I and III:

1. Use the setup in Figure 3-8 and the procedure under "AC Calibration."
2. For each point, take ac and dc measurements and enter them in copies of worksheet Figure 3-15 or Figure 3-16. Use Figure 3-15 and characterized dc settings for the 700 mV, 220 mV, and 70 mV ranges as follows: Set the 5700A to nominal, than use the knob to adjust for the error display you recorded in Table 3-3. The procedure to obtain those settings is described under "Characterizing the DC Source" at the beginning of the calibration instructions in this section. Use Figure 3-16 and nominal dc outputs for ranges other than those listed earlier in this step.
3. Calculate the ac-dc difference error as shown in Figure 3-15 or 3-16. Enter the result in the Table 3-13.

VERIFYING ABSOLUTE AC ERROR FOR REGION IV (70 mV THROUGH 700 mV RANGE) 3-28.

You calculate absolute ac error by measuring the absolute ac of the source signal and comparing it to the ac measured by the 5790A.

VOLTAGE (NOMINAL) ____________

FREQUENCY ____________

5700A ERROR DISPLAY FROM TABLE 3-3, POSITIVE ____________

5700A ERROR DISPLAY FROM TABLE 3-3, NEGATIVE ____________

792A CORRECTION (PPM) ____________

	792A	5790A
+DC		
–DC		
$DC_{AVERAGE}$	DC_{792} =	DC_{5790} =
AC	AC_{792} =	AC_{5790} =
AC – DC ERROR =		

$$DC_{AVERAGE} = \left(\frac{|+DC| + |-DC|}{2}\right)$$

$$AC - DC\ ERROR\ (PPM) = \left(\left[\frac{DC_{5790} - AC_{5790}}{DC_{5790}}\right] - \left[\frac{DC_{792} - AC_{792}}{DC_{792}}\right]\right) \cdot 10^6 + 792\ CORR$$

Figure 3-15. Worksheet for AC-DC Error, 70 mV through 700 mV Ranges

VOLTAGE (NOMIMAL) ____________________

FREQUENCY ____________________

792A CORRECTION (PPM) ____________________

	792A	5790A
+DC		
-DC		
$DC_{AVERAGE}$	DC_{792}=	DC_{5790}=
AC	AC_{792}=	AC_{5790}=
AC – DC ERROR =		

$$DC_{AVERAGE} = \left(\frac{|{+DC}| + |{-DC}|}{2}\right)$$

$$\text{AC – DC ERROR (PPM)} = \left(\left[\frac{DC_{5790} - AC_{5790}}{DC_{5790}}\right] - \left[\frac{DC_{792} - AC_{792}}{DC_{792}}\right]\right) \cdot 10^6 + 792\ \text{CORR}$$

Figure 3-16. Worksheet for AC-DC Error, All Other Ranges

Proceed as follows to verify absolute ac for Region IV:

1. Use the setup in Figure 3-8 and the procedure under "AC Calibration."
2. For each point, take ac and dc measurements and enter them in Figure 3-17. To verify the 5790A to its specifications, the tolerance of calibration source must meet or exceed the tolerances shown in Table 3-13. Use characterized dc settings as follows: Set the 5700A to nominal, then use the knob to adjust for the error display you recorded in Table 3-3.
3. Calculate the absolute ac error as shown in Figure 3-17. Enter the result in the Table 3-13.

VERIFYING ABSOLUTE AC ERROR FOR REGION II (2.2V THROUGH 1000V RANGE) 3-29.

Because of the loading of the 792A in its 700 mV to 1000V ranges, the dc voltage at the reference point of the calibration (center of the tee) is not the same as the dc voltage at the output terminals of the source unless sense terminals are provided for the source to the tee. If sense terminals are provided for dc, the absolute ac error may be determined as for region II; however, the sense connections should be removed when ac measurements are being made.

Alternatively, you can determine dc errors and ac-dc errors independently, then combine them. This is the procedure presented here.

In this case, you take measurements and make calculations in the same way as Regions I and III to obtain the ac-dc errors. (You may have already calculated these errors if you are verifying both the ac-dc and absolute ac performance of the instrument.) You then take dc measurements and calculate dc errors. Combine the errors to obtain absolute ac error.

VOLTAGE (NOMINAL) ____________________

FREQUENCY ____________________

5700A ERROR DISPLAY FROM TABLE 3-3, POSITIVE ____________________

5700A ERROR DISPLAY FROM TABLE 3-3, NEGATIVE ____________________

792A CORRECTION (PPM) ____________________

	792A	5790A
+DC		
−DC		
$DC_{AVERAGE}$	$DC_{792} =$	
AC	$AC_{792} =$	$AC_{5790} =$
AC ERROR =		

$$DC_{AVERAGE} = \left(\frac{|{+DC}| + |{-DC}|}{2}\right)$$

$$= \left[\frac{AC_{5790} - DC_{NOMINAL} \bullet \left(\frac{AC_{792}}{DC_{792}} + \frac{792_{CORR}}{10^{6}}\right)}{DC_{NOMINAL}}\right] \bullet 10^{6}$$

Figure 3-17. Worksheet for Absolute AC Error, 70 mV through 700 mV Ranges

Proceed as follows to use the error combination method:

1. To determine the dc errors, connect the test equipment as shown in Figure 3-5.
2. Use characterized 5700A dc settings as follows: Set the 5700A to nominal, than use the knob to adjust for the error display you recorded in Table 3-3. Take dual polarity dc readings and record them in Figure 3-18. To verify the 5790A to its specifications, the tolerance of the dc source must meet or exceed the tolerances shown in Table 3-10.
3. Calculate the dc error as shown in Figure 3-18.
4. Combine the dc errors and the ac-dc errors using the following equation to obtain the absolute ac reading error and enter the result in Table 3-13. AC READING ERROR = DC ERROR - (AC - DC ERROR)

VERIFYING ABSOLUTE AC ERROR FOR REGION V (2.2 mV THROUGH 22 mV) 3-30.

For the 7 mV through 22 mV ranges, use a bootstrapping technique. After you verify the 70 mV range, apply each test voltage and frequency to both the verified range and

VOLTAGE (NOMINAL) ____________________

5790 ERROR DISPLAY FROM TABLE 3-3, POSITIVE ____________

5790 ERROR DISPLAY FROM TABLE 3-3, NEGATIVE ____________

	5790A READING
+DC	
–DC	
DC_{5790} =	
DC_{ERROR} =	

$$DC_{5790} = \left(\frac{|{+DC}| + |{-DC}|}{2}\right)$$

$$\text{DC ERROR (PPM)} = \left(\frac{DC_{5790} - DC_{NOMINAL}}{DC_{NOMINAL}}\right) = \left(\frac{DC_{5790} - DC_{NOMINAL}}{DC_{NOMINAL}}\right) \bullet 10^6$$

Figure 3-18. Worksheet for DC Error, 2.2V through 1000V RANGES

the range under test. Accept the reading on the verified range after showing that it is operating within specifications. Step down through the ranges as described in the calibration procedures and shown in Figure 3-9 until the 2.2 mV range is verified. On each range tested, using the following formula. Enter the results in Table 3-13.

$$\text{AC ERROR (PPM)} = \left(\frac{\text{AC UUT RANGE - AC VERIFIED RANGE}}{\text{AC NOMINAL}}\right) \text{X } 10^6$$

Verifying the Wideband AC Option 3-31.

Wideband verification is an optional test for those who want to verify that the 5790A WIDEBAND input (requires Option 5790A-03) is within tolerance. There are two worksheets and one test record to facilitate this procedure. You will need 1 copy of Table 3-14, 8 copies of Table 3-15 (one for each voltage range) and 1 copy of the overall test record, Table 3-16.

Table 3-14. Worksheet for Wideband 22 mV, 7 mV, and 2.2 mV 1 kHz Absolute Verification

RANGE	INPUT VOLTAGE	MEASURED BY 5790A AT INPUT 1	MEASURED BY 8506A/8920A AT INPUT 1
22 mV	10 mV		
7 mV	3.2 mV		
2.2 mV	1 mV		

Table 3-15. Wideband Flatness Verification Worksheet

				______ RANGE					
FREQUENCY	A55 CORR. (PPM)	5790A ERROR (PPM)	5700A ERROR (PPM)	10 dB ERROR (PPM)	20 dB ERROR (PPM)	20 dB ERROR (PPM)	20 dB ERROR (PPM)	TOTAL ERROR (PPM)	1 kHz REF ERROR (ENTER ONCE)
10 Hz									
20 Hz									x
50 Hz									x
100 Hz									x
200 Hz									x
2 kHz									x
10 kHz									x
20 kHz									x
50 kHz									x
100 kHz									x
200 kHz									x
500 kHz									x
700 kHz									x
1 MHz									x
1.2 MHz									x
2 MHz									x
3 MHz									x
4 MHz									x
6 MHz									x
8 MHz									x
9 MHz									x
10 MHz									x
12 MHz									x
15 MHz									x
17 MHz									x
20 MHz									x
23 MHz									x
26 MHz									x
28 MHz									x
30 MHz									x

WIDEBAND 1-kHz GAIN VERIFICATION, 7V, 2.2V, 700 mV, 220 mV, and 70 mV RANGES 3-32.

1. Connect the equipment as shown in Figure 3-12. Set the 8506A to the HI ACCUR mode.
2. Set the 5790A to the WIDEBAND 7V range.
3. Apply 3.2V at 1 kHz from the 5700A and then adjust the 5700A so that the 5790A reads 3.2000.
4. Press the "SET REF" soft key on the 5790A.
5. Readjust the 5700A until the 8506A reads 3.20000V.
6. Read the error on the 5790A display and record on the 1 kHz line in Table 3-16.
7. Proceed to the 2.2V, 700 mV, 220 mV, and 70 mV ranges and apply the voltages and attenuators listed in Table 3-9. Repeat steps 3, 4, 5, and 6 except use the input value listed in Table 3-9 for that range.

WIDEBAND 1-kHz GAIN VERIFICATION, 22 mV RANGE 3-33.

1. Connect the equipment as shown in Figure 3-19 with 50-dB of attenuation.
2. Set the 5790A to the 22 mV range, INPUT 1.
3. Set the 5700A to 3.2V 1 kHz to give approximately 10 mV at the 5790A INPUT 1.
4. Let the 8920A autorange to the 20 mV range as indicated by the 8920A analog meter reading approximately 1/2 scale.
5. Press the 8920A "RANGE HOLD" button to keep the 8920A on the 20 mV range.
6. Read and record the 5790A voltage display and the 8506A DMM display in Table 3-14.
7. Move the input to the WIDEBAND input of the 5790A as shown in Figure 3-20. Remove the 50Ω termination but keep the 50 dB of attenuation.
8. Set the 5790A to WBND and 22 mV range.
9. Readjust the 5700A to give the same reading on the 5790A as you recorded at INPUT 1.

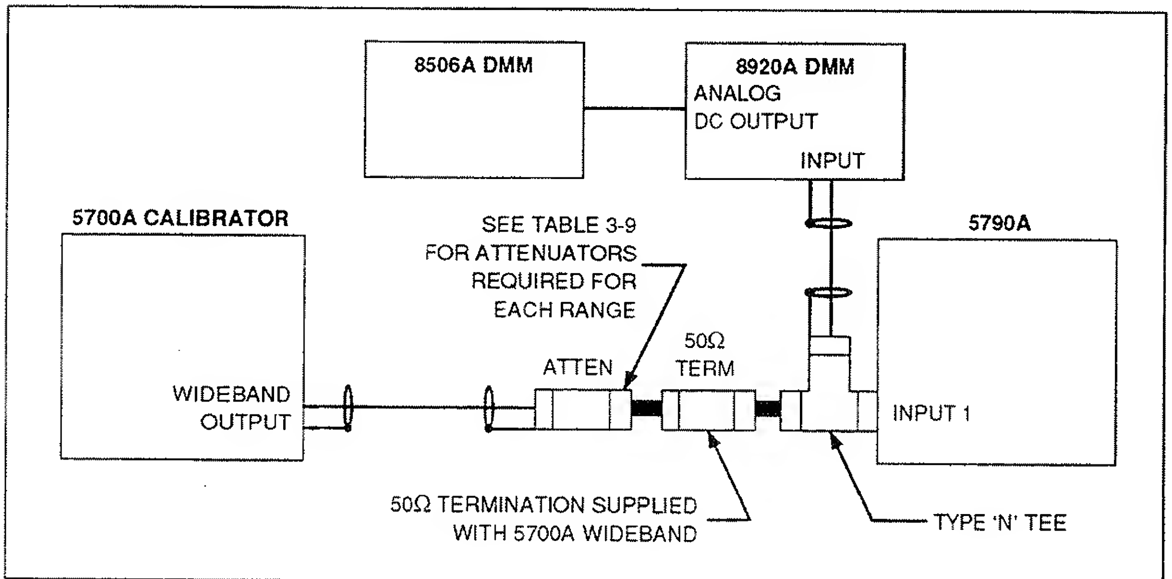


Figure 3-19. Wideband Verification Test Setup, Part 1

10. Press the "SET REF" soft key on the 5790A.
11. Readjust the 5700A to give the same reading on the 8506A DMM as recorded above.
12. Read and record the error on the 5790A display in Table 3-16.

WIDEBAND 1-kHz GAIN VERIFICATION, 7 mV RANGE 3-34.

1. Connect the equipment as shown in Figure 3-19 with 60 dB of attenuation.
2. Set the 5790A to the 7 mV range, and INPUT 1.
3. Set the 5700A to 3.2V at 1 kHz to give approximately 3.2 mV at the 5790A INPUT 1.
4. Let the 8920A DVM autorange to the 20 mV range as indicated by the 8920A analog meter reading approximately 1/6 scale.
5. Press the 8920A "RANGE HOLD" button.
6. Read and record the 5790A voltage display and the 8506A DMM display in Table 3-14.
7. Move the input to the WIDEBAND input of the 5790A as shown in Figure 3-20. Remove the 50Ω termination but keep the 60 dB of attenuation.
8. Set the 5790A to WBND and 7 mV range.
9. Readjust the 5700A to give the same reading on the 5790A as recorded above at INPUT 1.
10. Press the "SET REF" soft key on the 5790A.
11. Readjust the 5700A to give the same reading on the 8506A DMM as recorded above.
12. Read and record the error on the 5790A display in Table 3-16.

WIDEBAND 1-kHz GAIN VERIFICATION, 2.2 mV RANGE 3-35.

1. Connect the equipment as shown in Figure 3-19 with 70 dB of attenuation.

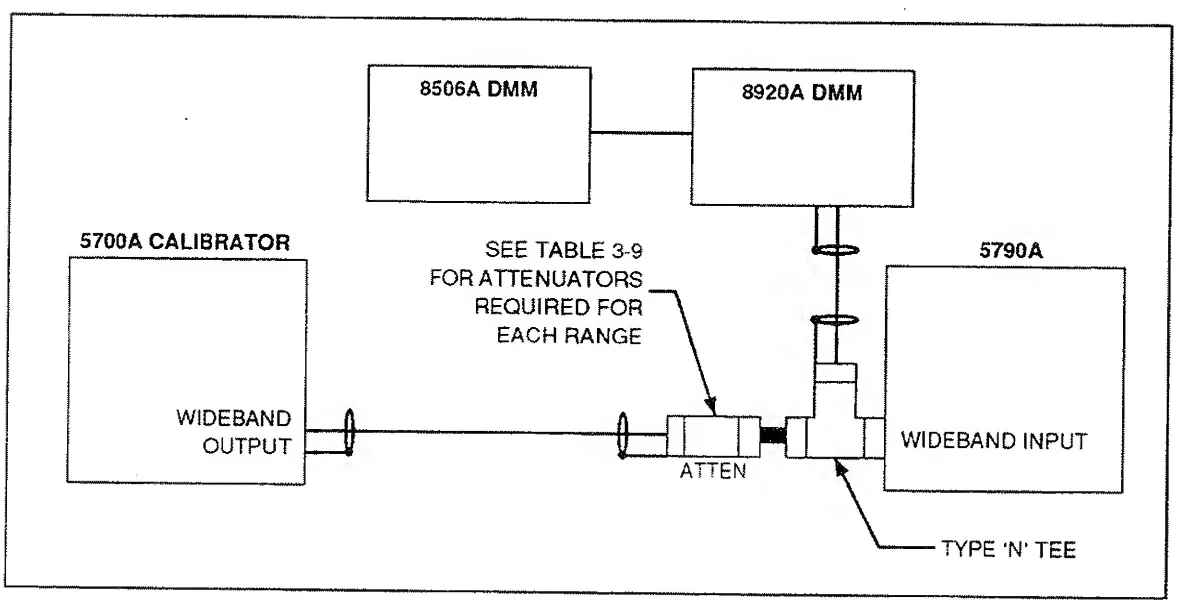


Figure 3-20. Wideband Verification Test Setup, Part 2

2. Set the 5790A to the 2.2 mV range, INPUT 1.
3. Set the 5700A to 3.2V at 1 kHz, to produce approximately 1.0 mV at the 5790A INPUT 1.
4. Let the 8920A DVM autorange to the 2 mV range as indicated by the 8920A analog meter reading approximately 1/2 scale. (Press the 8920A "LOW RANGE ENABLE" switch to get the 2 mV range).
5. Press the 8920A "RANGE HOLD" button.
6. Read and record the 5790A voltage display and the 8506A DMM display in Table 3-14.
7. Move the input to the WIDEBAND input of the 5790A as shown in Figure 3-20. Remove the 50Ω termination but keep the 70 dB of attenuation.
8. Set the 5790A to WBND and 2.2 mV range.
9. Readjust the 5700A to give the same reading on the 5790A as recorded above at INPUT 1.
10. Press the "SET REF" soft key on the 5790A.
11. Readjust the 5700A to give the same reading on the 8506A DMM as recorded above.
12. Read and record the error on the 5790A display in Table 3-16.

WIDEBAND GAIN VERIFICATION, 10 Hz TO 500 kHz 3-36.

Gain errors at frequencies other than 1kHz can be determined by adding the error measured at 1 kHz for that range to the error measured during wideband flatness verification. See Table 3-16.

WIDEBAND FLATNESS VERIFICATION 3-37.

Proceed as follows to verify WIDEBAND input flatness:

1. Characterize the ac source by following the procedure under the heading "Characterizing the AC Source" in the Wideband Calibration procedure, earlier in this section. Use the Wideband Flatness Verification Worksheet, Table 3-15 instead of Table 3-8. (More frequencies are verified than are calibrated).
2. Connect the equipment as shown in Figure 3-13.
3. The 5700A will be set to a nominal 3.2V for all flatness verifications. The only deviation from the nominal value will be for calibration corrections for the 5700A and the attenuators.
4. Table 3-9 shows the combinations of attenuators required to scale the input signal properly for each range.
5. All ranges are verified in a similar manner.
6. Obtain 8 copies of Table 3-15 with the 5700A errors recorded in the table; one for each of the 8 voltage ranges.
7. Enter the range (7V, 2.2V, 700 mV, 220 mV, 70 mV, 22 mV, 7 mV, and 2.2 mV) in the box at the top of each table.
8. Enter the attenuator corrections as required for each range and add up the errors and enter in the "TOTAL ERROR" column. The total error is the sum of errors of the 5700A and all attenuators used for that frequency.
9. Proceed to verify each range by first establishing the 1kHz reference at the beginning of each range.
10. To establish the 1-kHz reference, set the 5700A to 3.2V and 1kHz. Let the 5790A measure this value. Record the value in Table 3-15.
11. Press the "SET REF" soft key on the 5790A.

12. Proceed to the first frequency listed in Table 3-15 and adjust the 5700A to the TOTAL ERROR value (sign and magnitude) listed in Table 3-15.
13. Read the error on the 5790A error display and record in the WIDEBAND input verification test record, Table 3-16.
14. Proceed to the next frequency in the table and set the 5700A to 3.2V. (the error values are set relative to the nominal 3.2V level). Adjust the 5700A to the TOTAL ERROR value (sign and magnitude) listed in Table 3-15, and read and record the error in Table 3-16.
15. Repeat step 14 for all frequencies in Table 3-15 for that range.
16. Proceed to the next range and establish the 1-kHz reference at 3.2V as in step 10 above. Press the "SET REF" soft key on the 5790A, and proceed through each frequency in the table. Reset the 5700A to 3.2V after each frequency is measured. The error values are set relative to the nominal 3.2V level.
17. Verify all other ranges in the same way.

Table 3-16. Wideband Verification Test Record

STEP NO.	5790A RANGE	TEST VOLTAGE	FREQUENCY	IF USING METHODS OTHER THAN SPECIFIED, MAX UNCERT (NOTE)	1-YEAR FLATNESS SPECIFICATION	MEASURED FLATNESS ERROR (%)	90-DAY ABSOLUTE ERROR SPEC (%)	MEASURED ABSOLUTE ERROR (%)
1	7V	3.2V	10 Hz	0.012*	0.10		0.31	
2	7V	3.2V	20 Hz	0.007*	0.10		0.31	
3	7V	3.2V	50 Hz	0.007*	0.03		0.31	
4	7V	3.2V	100 Hz	0.007*	0.03		0.31	
5	7V	3.2V	200 Hz	0.007*	0.03		0.31	
6	7V	3.2V	1 kHz	0.08**	N/A		0.31	
7	7V	3.2V	2 kHz	0.007*	0.03		0.31	
8	7V	3.2V	10 kHz	0.007*	0.03		0.31	
9	7V	3.2V	20 kHz	0.007*	0.03		0.31	
10	7V	3.2V	50 kHz	0.007*	0.03		0.31	
11	7V	3.2V	100 kHz	0.007*	0.03		0.31	
12	7V	3.2V	200 kHz	0.020*	0.03		0.31	
13	7V	3.2V	500 kHz	0.020*	0.03		0.31	
14	7V	3.2V	700 kHz	0.025*	0.05		No Spec	No Spec
15	7V	3.2V	1 MHz	0.025*	0.05		No Spec	No Spec
16	7V	3.2V	1.2 MHz	0.050*	0.05		No Spec	No Spec
17	7V	3.2V	2 MHz	0.050*	0.05		No Spec	No Spec
18	7V	3.2V	3 MHz	0.100*	0.10		No Spec	No Spec
19	7V	3.2V	4 MHz	0.100*	0.10		No Spec	No Spec
20	7V	3.2V	6 MHz	0.100*	0.10		No Spec	No Spec
21	7V	3.2V	8 MHz	0.100*	0.10		No Spec	No Spec
22	7V	3.2V	9 MHz	0.100*	0.10		No Spec	No Spec
23	7V	3.2V	10 MHz	0.100*	0.10		No Spec	No Spec
24	7V	3.2V	12 MHz	0.100*	0.15		No Spec	No Spec

Table 3-16. Wideband Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE	FREQUENCY	IF USING METHODS OTHER THAN SPECIFIED, MAX UNCERT (NOTE)	1-YEAR FLATNESS SPECIFICATION	MEASURED FLATNESS ERROR (%)	90-DAY ABSOLUTE ERROR SPEC (%)	MEASURED ABSOLUTE ERROR (%)
25	7V	3.2V	15 MHz	0.100*	0.15		No Spec	No Spec
26	7V	3.2V	17 MHz	0.150*	0.15		No Spec	No Spec
27	7V	3.2V	20 MHz	0.150*	0.15		No Spec	No Spec
28	7V	3.2V	23 MHz	0.200*	0.35		No Spec	No Spec
29	7V	3.2V	26 MHz	0.200*	0.35		No Spec	No Spec
30	7V	3.2V	28 MHz	0.200*	0.35		No Spec	No Spec
31	7V	3.2V	30 MHz	0.200*	0.35		No Spec	No Spec
32	2.2V	1.0V	10 Hz	0.013*	0.10		0.33	
33	2.2V	1.0V	20 Hz	0.009*	0.10		0.33	
34	2.2V	1.0V	50 Hz	0.009*	0.03		0.33	
35	2.2V	1.0V	100 Hz	0.009*	0.03		0.33	
36	2.2V	1.0V	200 Hz	0.009*	0.03		0.33	
37	2.2V	1.0V	1 kHz	0.08**	N/A		0.33	
38	2.2V	1.0V	2 kHz	0.009*	0.03		0.33	
39	2.2V	1.0V	10 kHz	0.009*	0.03		0.33	
40	2.2V	1.0V	20 kHz	0.009*	0.03		0.33	
41	2.2V	1.0V	50 kHz	0.009*	0.03		0.33	
42	2.2V	1.0V	100 kHz	0.009*	0.03		0.33	
43	2.2V	1.0V	200 kHz	0.021*	0.03		0.33	
44	2.2V	1.0V	500 kHz	0.021*	0.03		0.33	
45	2.2V	1.0V	700 kHz	0.025*	0.05		No Spec	No Spec
46	2.2V	1.0V	1 MHz	0.025*	0.05		No Spec	No Spec
47	2.2V	1.0V	1.2 MHz	0.050*	0.05		No Spec	No Spec
48	2.2V	1.0V	2 MHz	0.050*	0.05		No Spec	No Spec

Table 3-16. Wideband Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE	FREQUENCY	IF USING METHODS OTHER THAN SPECIFIED, MAX UNCERT (NOTE)	1-YEAR FLATNESS SPECIFICATION	MEASURED FLATNESS ERROR (%)	90-DAY ABSOLUTE ERROR SPEC (%)	MEASURED ABSOLUTE ERROR (%)
49	2.2V	1.0V	3 MHz	0.100*	0.10		No Spec	No Spec
50	2.2V	1.0V	4 MHz	0.100*	0.10		No Spec	No Spec
51	2.2V	1.0V	6 MHz	0.100*	0.10		No Spec	No Spec
52	2.2V	1.0V	8 MHz	0.100*	0.10		No Spec	No Spec
53	2.2V	1.0V	9 MHz	0.100*	0.10		No Spec	No Spec
54	2.2V	1.0V	10 MHz	0.100*	0.10		No Spec	No Spec
55	2.2V	1.0V	12 MHz	0.101*	0.15		No Spec	No Spec
56	2.2V	1.0V	15 MHz	0.101*	0.15		No Spec	No Spec
57	2.2V	1.0V	17 MHz	0.151*	0.15		No Spec	No Spec
58	2.2V	1.0V	20 MHz	0.151*	0.15		No Spec	No Spec
59	2.2V	1.0V	23 MHz	0.201*	0.35		No Spec	No Spec
60	2.2V	1.0V	26 MHz	0.202*	0.35		No Spec	No Spec
61	2.2V	1.0V	28 MHz	0.202*	0.35		No Spec	No Spec
62	2.2V	1.0V	30 MHz	0.202*	0.35		No Spec	No Spec
63	700 mV	320 mV	10 Hz	0.013*	0.10		0.36	
64	700 mV	320 mV	20 Hz	0.009*	0.10		0.36	
65	700 mV	320 mV	50 Hz	0.009*	0.03		0.36	
66	700 mV	320 mV	100 Hz	0.009*	0.03		0.36	
67	700 mV	320 mV	200 Hz	0.009*	0.03		0.36	
68	700 mV	320 mV	1 kHz	0.08**	N/A		0.36	
69	700 mV	320 mV	2 kHz	0.009*	0.03		0.36	
70	700 mV	320 mV	10 kHz	0.009*	0.03		0.36	
71	700 mV	320 mV	20 kHz	0.009*	0.03		0.36	
72	700 mV	320 mV	50 kHz	0.009*	0.03		0.36	

Table 3-16. Wideband Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE	FREQUENCY	IF USING METHODS OTHER THAN SPECIFIED, MAX UNCERT (NOTE)	1-YEAR FLATNESS SPECIFICATION	MEASURED FLATNESS ERROR (%)	90-DAY ABSOLUTE ERROR SPEC (%)	MEASURED ABSOLUTE ERROR (%)
73	700 mV	320 mV	100 kHz	0.009*	0.03		0.36	
74	700 mV	320 mV	200 kHz	0.012*	0.03		0.36	
75	700 mV	320 mV	500 kHz	0.012*	0.03		0.36	
76	700 mV	320 mV	700 kHz	0.025*	0.05		No Spec	No Spec
77	700 mV	320 mV	1 MHz	0.025*	0.05		No Spec	No Spec
78	700 mV	320 mV	1.2 MHz	0.050*	0.05		No Spec	No Spec
79	700 mV	320 mV	2 MHz	0.051*	0.05		No Spec	No Spec
80	700 mV	320 mV	3 MHz	0.100*	0.10		No Spec	No Spec
81	700 mV	320 mV	4 MHz	0.100*	0.10		No Spec	No Spec
82	700 mV	320 mV	6 MHz	0.100*	0.10		No Spec	No Spec
83	700 mV	320 mV	8 MHz	0.101*	0.10		No Spec	No Spec
84	700 mV	320 mV	9 MHz	0.101*	0.10		No Spec	No Spec
85	700 mV	320 mV	10 MHz	0.101*	0.10		No Spec	No Spec
86	700 mV	320 mV	12 MHz	0.101*	0.15		No Spec	No Spec
87	700 mV	320 mV	15 MHz	0.102*	0.15		No Spec	No Spec
88	700 mV	320 mV	17 MHz	0.152*	0.15		No Spec	No Spec
89	700 mV	320 mV	20 MHz	0.153*	0.15		No Spec	No Spec
90	700 mV	320 mV	23 MHz	0.203*	0.35		No Spec	No Spec
91	700 mV	320 mV	26 MHz	0.204*	0.35		No Spec	No Spec
92	700 mV	320 mV	28 MHz	0.205*	0.35		No Spec	No Spec
93	700 mV	320 mV	30 MHz	0.206*	0.35		No Spec	No Spec
94	220 mV	100 mV	10 Hz	0.014*	0.10		0.36	
95	220 mV	100 mV	20 Hz	0.010*	0.10		0.36	
96	220 mV	100 mV	50 Hz	0.010*	0.04		0.36	

Table 3-16. Wideband Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE	FREQUENCY	IF USING METHODS OTHER THAN SPECIFIED, MAX UNCERT (NOTE)	1-YEAR FLATNESS SPECIFICATION	MEASURED FLATNESS ERROR (%)	90-DAY ABSOLUTE ERROR SPEC (%)	MEASURED ABSOLUTE ERROR (%)
97	220 mV	100 mV	100 Hz	0.010*	0.04		0.36	
98	220 mV	100 mV	200 Hz	0.010*	0.04		0.36	
99	220 mV	100 mV	1 kHz	0.08**	N/A		0.36	
100	220 mV	100 mV	2 kHz	0.010*	0.04		0.36	
101	220 mV	100 mV	10 kHz	0.010*	0.04		0.36	
102	220 mV	100 mV	20 kHz	0.010*	0.04		0.36	
103	220 mV	100 mV	50 kHz	0.010*	0.04		0.36	
104	220 mV	100 mV	100 kHz	0.010*	0.04		0.36	
105	220 mV	100 mV	200 kHz	0.021*	0.04		0.36	
106	220 mV	100 mV	500 kHz	0.021*	0.04		0.36	
107	220 mV	100 mV	700 kHz	0.026*	0.05		No Spec	No Spec
108	220 mV	100 mV	1 MHz	0.026*	0.05		No Spec	No Spec
109	220 mV	100 mV	1.2 MHz	0.051*	0.05		No Spec	No Spec
110	220 mV	100 mV	2 MHz	0.051*	0.05		No Spec	No Spec
111	220 mV	100 mV	3 MHz	0.101*	0.10		No Spec	No Spec
112	220 mV	100 mV	4 MHz	0.101*	0.10		No Spec	No Spec
113	220 mV	100 mV	6 MHz	0.101*	0.10		No Spec	No Spec
114	220 mV	100 mV	8 MHz	0.101*	0.10		No Spec	No Spec
115	220 mV	100 mV	9 MHz	0.101*	0.10		No Spec	No Spec
116	220 mV	100 mV	10 MHz	0.101*	0.10		No Spec	No Spec
117	220 mV	100 mV	12 MHz	0.102*	0.15		No Spec	No Spec
118	220 mV	100 mV	15 MHz	0.103*	0.15		No Spec	No Spec
119	220 mV	100 mV	17 MHz	0.153*	0.15		No Spec	No Spec
120	220 mV	100 mV	20 MHz	0.154*	0.15		No Spec	No Spec

Table 3-16. Wideband Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE	FREQUENCY	IF USING METHODS OTHER THAN SPECIFIED, MAX UNCERT (NOTE)	1-YEAR FLATNESS SPECIFICATION	MEASURED FLATNESS ERROR (%)	90-DAY ABSOLUTE ERROR SPEC (%)	MEASURED ABSOLUTE ERROR (%)
121	220 mV	100 mV	23 MHz	0.205*	0.35		No Spec	No Spec
122	220 mV	100 mV	26 MHz	0.206*	0.35		No Spec	No Spec
123	220 mV	100 mV	28 MHz	0.207*	0.35		No Spec	No Spec
124	220 mV	100 mV	30 MHz	0.208*	0.35		No Spec	No Spec
125	70 mV	32 mV	10 Hz	0.014*	0.10		0.46	
126	70 mV	32 mV	20 Hz	0.010*	0.10		0.46	
127	70 mV	32 mV	50 Hz	0.010*	0.05		0.46	
128	70 mV	32 mV	100 Hz	0.010*	0.05		0.46	
129	70 mV	32 mV	200 Hz	0.010*	0.05		0.46	
130	70 mV	32 mV	1 kHz	0.10**	N/A		0.46	
131	70 mV	32 mV	2 kHz	0.010*	0.05		0.46	
132	70 mV	32 mV	10 kHz	0.010*	0.05		0.46	
133	70 mV	32 mV	20 kHz	0.010*	0.05		0.46	
134	70 mV	32 mV	50 kHz	0.010*	0.05		0.46	
135	70 mV	32 mV	100 kHz	0.010*	0.05		0.46	
136	70 mV	32 mV	200 kHz	0.021*	0.05		0.46	
137	70 mV	32 mV	500 kHz	0.021*	0.05		0.46	
138	70 mV	32 mV	700 kHz	0.026*	0.05		No Spec	No Spec
139	70 mV	32 mV	1 MHz	0.051*	0.05		No Spec	No Spec
140	70 mV	32 mV	1.2 MHz	0.051*	0.05		No Spec	No Spec
141	70 mV	32 mV	2 MHz	0.101*	0.05		No Spec	No Spec
142	70 mV	32 mV	3 MHz	0.101*	0.10		No Spec	No Spec
143	70 mV	32 mV	4 MHz	0.101*	0.10		No Spec	No Spec
144	70 mV	32 mV	6 MHz	0.101*	0.10		No Spec	No Spec

Table 3-16. Wideband Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE	FREQUENCY	IF USING METHODS OTHER THAN SPECIFIED, MAX UNCERT (NOTE)	1-YEAR FLATNESS SPECIFICATION	MEASURED FLATNESS ERROR (%)	90-DAY ABSOLUTE ERROR SPEC (%)	MEASURED ABSOLUTE ERROR (%)
145	70 mV	32 mV	8 MHz	0.101*	0.10		No Spec	No Spec
146	70 mV	32 mV	9 MHz	0.101*	0.10		No Spec	No Spec
147	70 mV	32 mV	10 MHz	0.101*	0.10		No Spec	No Spec
148	70 mV	32 mV	12 MHz	0.102*	0.15		No Spec	No Spec
149	70 mV	32 mV	15 MHz	0.104*	0.15		No Spec	No Spec
150	70 mV	32 mV	17 MHz	0.154*	0.15		No Spec	No Spec
151	70 mV	32 mV	20 MHz	0.156*	0.15		No Spec	No Spec
152	70 mV	32 mV	23 MHz	0.206*	0.35		No Spec	No Spec
153	70 mV	32 mV	26 MHz	0.209*	0.35		No Spec	No Spec
154	70 mV	32 mV	28 MHz	0.210*	0.35		No Spec	No Spec
155	70 mV	32 mV	30 MHz	0.212*	0.35		No Spec	No Spec
156	22 mV	10 mV	10 Hz	0.015*	0.10		0.5	
157	22 mV	10 mV	20 Hz	0.011*	0.10		0.5	
158	22 mV	10 mV	50 Hz	0.011*	0.05		0.5	
159	22 mV	10 mV	100 Hz	0.011*	0.05		0.5	
160	22 mV	10 mV	200 Hz	0.011*	0.05		0.5	
161	22 mV	10 mV	1 kHz	0.10**	N/A		0.5	
162	22 mV	10 mV	2 kHz	0.011*	0.05		0.5	
163	22 mV	10 mV	10 kHz	0.011*	0.05		0.5	
164	22 mV	10 mV	20 kHz	0.011*	0.05		0.5	
165	22 mV	10 mV	50 kHz	0.011*	0.05		0.5	
166	22 mV	10 mV	100 kHz	0.011*	0.05		0.5	
167	22 mV	10 mV	200 kHz	0.022*	0.07		0.5	
168	22 mV	10 mV	500 kHz	0.022*	0.07		0.5	

Table 3-16. Wideband Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE	FREQUENCY	IF USING METHODS OTHER THAN SPECIFIED, MAX UNCERT (NOTE)	1-YEAR FLATNESS SPECIFICATION	MEASURED FLATNESS ERROR (%)	90-DAY ABSOLUTE ERROR SPEC (%)	MEASURED ABSOLUTE ERROR (%)
169	22 mV	10 mV	700 kHz	0.026*	0.07		No Spec	No Spec
170	22 mV	10 mV	1 MHz	0.026*	0.07		No Spec	No Spec
171	22 mV	10 mV	1.2 MHz	0.051*	0.07		No Spec	No Spec
172	22 mV	10 mV	2 MHz	0.052*	0.07		No Spec	No Spec
173	22 mV	10 mV	3 MHz	0.101*	0.10		No Spec	No Spec
174	22 mV	10 mV	4 MHz	0.101*	0.10		No Spec	No Spec
175	22 mV	10 mV	6 MHz	0.101*	0.10		No Spec	No Spec
176	22 mV	10 mV	8 MHz	0.102*	0.10		No Spec	No Spec
177	22 mV	10 mV	9 MHz	0.102*	0.10		No Spec	No Spec
178	22 mV	10 mV	10 MHz	0.102*	0.10		No Spec	No Spec
179	22 mV	10 mV	12 MHz	0.103*	0.17		No Spec	No Spec
180	22 mV	10 mV	15 MHz	0.105*	0.17		No Spec	No Spec
181	22 mV	10 mV	17 MHz	0.155*	0.17		No Spec	No Spec
182	22 mV	10 mV	20 MHz	0.157*	0.17		No Spec	No Spec
183	22 mV	10 mV	23 MHz	0.208*	0.37		No Spec	No Spec
184	22 mV	10 mV	26 MHz	0.210*	0.37		No Spec	No Spec
185	22 mV	10 mV	28 MHz	0.212*	0.37		No Spec	No Spec
186	22 mV	10 mV	30 MHz	0.214*	0.37		No Spec	No Spec
187	7 mV	3.2 mV	10 Hz	0.015*	0.10		0.55	
188	7 mV	3.2 mV	20 Hz	0.011*	0.10		0.55	
189	7 mV	3.2 mV	50 Hz	0.011*	0.05		0.55	
190	7 mV	3.2 mV	100 Hz	0.011*	0.05		0.55	
191	7 mV	3.2 mV	200 Hz	0.011*	0.05		0.55	
192	7 mV	3.2 mV	1 kHz	0.10**	N/A		0.55	

Table 3-16. Wideband Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE	FREQUENCY	IF USING METHODS OTHER THAN SPECIFIED, MAX UNCERT (NOTE)	1-YEAR FLATNESS SPECIFICATION	MEASURED FLATNESS ERROR (%)	90-DAY ABSOLUTE ERROR SPEC (%)	MEASURED ABSOLUTE ERROR (%)
193	7 mV	3.2 mV	2 kHz	0.011*	0.05		0.55	
194	7 mV	3.2 mV	10 kHz	0.011*	0.05		0.55	
195	7 mV	3.2 mV	20 kHz	0.011*	0.05		0.55	
196	7 mV	3.2 mV	50 kHz	0.011*	0.05		0.55	
197	7 mV	3.2 mV	100 kHz	0.011*	0.05		0.55	
198	7 mV	3.2 mV	200 kHz	0.022*	0.10		0.55	
199	7 mV	3.2 mV	500 kHz	0.022*	0.10		0.55	
200	7 mV	3.2 mV	700 kHz	0.026*	0.10		No Spec	No Spec
201	7 mV	3.2 mV	1 MHz	0.026*	0.10		No Spec	No Spec
202	7 mV	3.2 mV	1.2 MHz	0.051*	0.10		No Spec	No Spec
203	7 mV	3.2 mV	2 MHz	0.052*	0.10		No Spec	No Spec
204	7 mV	3.2 mV	3 MHz	0.101*	0.13		No Spec	No Spec
205	7 mV	3.2 mV	4 MHz	0.101*	0.13		No Spec	No Spec
206	7 mV	3.2 mV	6 MHz	0.101*	0.13		No Spec	No Spec
207	7 mV	3.2 mV	8 MHz	0.102*	0.13		No Spec	No Spec
208	7 mV	3.2 mV	9 MHz	0.102*	0.13		No Spec	No Spec
209	7 mV	3.2 mV	10 MHz	0.102*	0.13		No Spec	No Spec
210	7 mV	3.2 mV	12 MHz	0.104*	0.20		No Spec	No Spec
211	7 mV	3.2 mV	15 MHz	0.106*	0.20		No Spec	No Spec
212	7 mV	3.2 mV	17 MHz	0.156*	0.20		No Spec	No Spec
213	7 mV	3.2 mV	20 MHz	0.159*	0.20		No Spec	No Spec
214	7 mV	3.2 mV	23 MHz	0.209*	0.40		No Spec	No Spec
215	7 mV	3.2 mV	26 MHz	0.213*	0.40		No Spec	No Spec
216	7 mV	3.2 mV	28 MHz	0.215*	0.40		No Spec	No Spec

Table 3-16. Wideband Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE	FREQUENCY	IF USING METHODS OTHER THAN SPECIFIED, MAX UNCERT (NOTE)	1-YEAR FLATNESS SPECIFICATION	MEASURED FLATNESS ERROR (%)	90-DAY ABSOLUTE ERROR SPEC (%)	MEASURED ABSOLUTE ERROR (%)
217	7 mV	3.2 mV	30 MHz	0.218*	0.40		No Spec	No Spec
218	2.2 mV	1 mV	10 Hz	0.016*	0.10		0.62	
219	2.2 mV	1 mV	20 Hz	0.012*	0.10		0.62	
220	2.2 mV	1 mV	50 Hz	0.012*	0.05		0.62	
221	2.2 mV	1 mV	100 Hz	0.012*	0.05		0.62	
222	2.2 mV	1 mV	200 Hz	0.012*	0.05		0.62	
223	2.2 mV	1 mV	1 kHz	0.15**	N/A		0.62	
224	2.2 mV	1 mV	2 kHz	0.012*	0.05		0.62	
225	2.2 mV	1 mV	10 kHz	0.012*	0.05		0.62	
226	2.2 mV	1 mV	20 kHz	0.012*	0.05		0.62	
227	2.2 mV	1 mV	50 kHz	0.012*	0.05		0.62	
228	2.2 mV	1 mV	100 kHz	0.012*	0.05		0.62	
229	2.2 mV	1 mV	200 kHz	0.022*	0.16		0.62	
230	2.2 mV	1 mV	500 kHz	0.022*	0.16		0.62	
231	2.2 mV	1 mV	700 kHz	0.027*	0.16		No Spec	No Spec
232	2.2 mV	1 mV	1 MHz	0.027*	0.16		No Spec	No Spec
233	2.2 mV	1 mV	1.2 MHz	0.051*	0.16		No Spec	No Spec
234	2.2 mV	1 mV	2 MHz	0.052*	0.16		No Spec	No Spec
235	2.2 mV	1 mV	3 MHz	0.101*	0.26		No Spec	No Spec
236	2.2 mV	1 mV	4 MHz	0.102*	0.26		No Spec	No Spec
237	2.2 mV	1 mV	6 MHz	0.102*	0.26		No Spec	No Spec
238	2.2 mV	1 mV	8 MHz	0.102*	0.26		No Spec	No Spec
239	2.2 mV	1 mV	9 MHz	0.102*	0.26		No Spec	No Spec
240	2.2 mV	1 mV	10 MHz	0.103*	0.26		No Spec	No Spec

Table 3-16. Wideband Verification Test Record (cont)

STEP NO.	5790A RANGE	TEST VOLTAGE	FREQUENCY	IF USING METHODS OTHER THAN SPECIFIED, MAX UNCERT (NOTE)	1-YEAR FLATNESS SPECIFICATION	MEASURED FLATNESS ERROR (%)	90-DAY ABSOLUTE ERROR SPEC (%)	MEASURED ABSOLUTE ERROR (%)
241	2.2 mV	1 mV	12 MHz	0.104*	0.39		No Spec	No Spec
242	2.2 mV	1 mV	15 MHz	0.107*	0.39		No Spec	No Spec
243	2.2 mV	1 mV	17 MHz	0.157*	0.39		No Spec	No Spec
244	2.2 mV	1 mV	20 MHz	0.160*	0.39		No Spec	No Spec
245	2.2 mV	1 mV	23 MHz	0.211*	0.88		No Spec	No Spec
246	2.2 mV	1 mV	26 MHz	0.214*	0.88		No Spec	No Spec
247	2.2 mV	1 mV	28 MHz	0.217*	0.88		No Spec	No Spec
248	2.2 mV	1 mV	30 MHz	0.220*	0.88		No Spec	No Spec

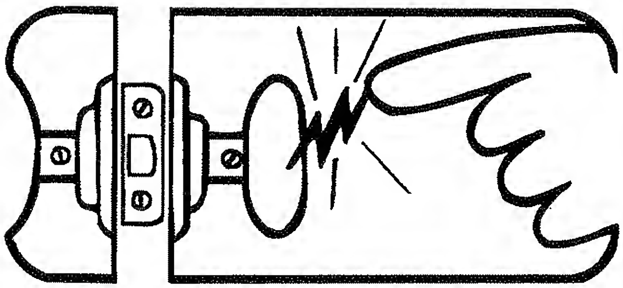
NOTE: You do not need to use the information in this column if you use the specified equipment and methods. These are minimum use specifications that you can use for planning Wideband calibration or verification using alternate equipment and methods.

* Minimum use uncertainty relative to the 1-kHz point in this range

** Minimum use absolute uncertainty

static awareness

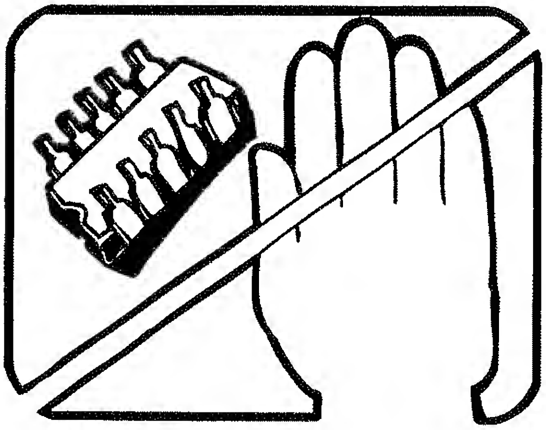
A Message From
Fluke Corporation



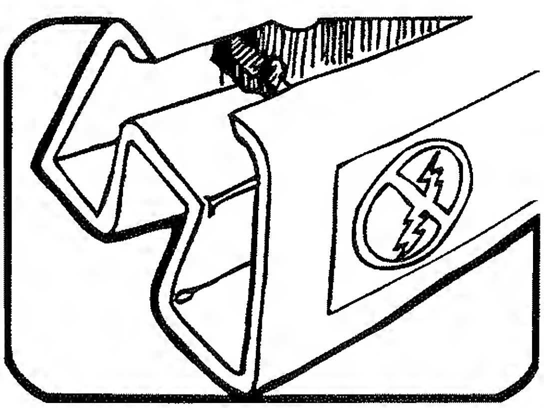
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Leaning the guidelines for handling them.
3. Using the procedures, packaging, and bench techniques that are recommended.

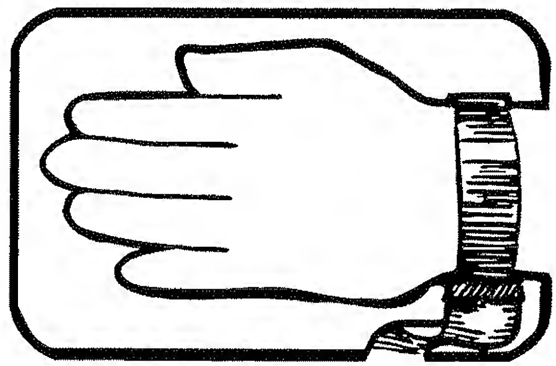
The following practices should be followed to minimize damage to S.S. (static sensitive) devices.



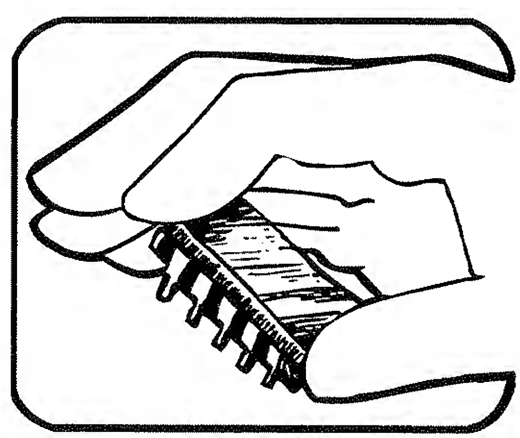
1. MINIMIZE HANDLING



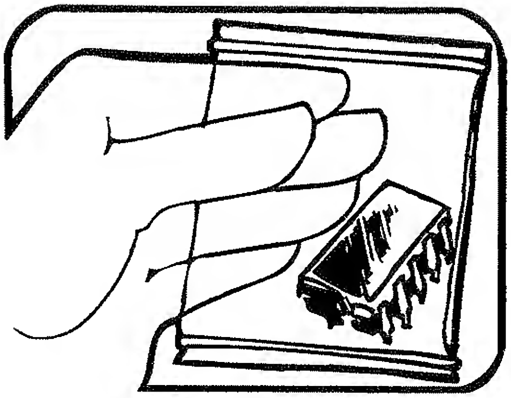
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



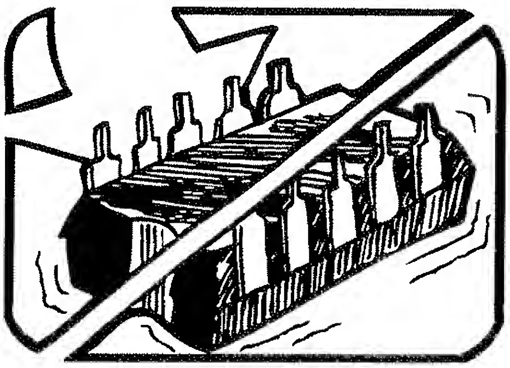
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES. USE A HIGH RESISTANCE GROUNDING WRIST STRAP.



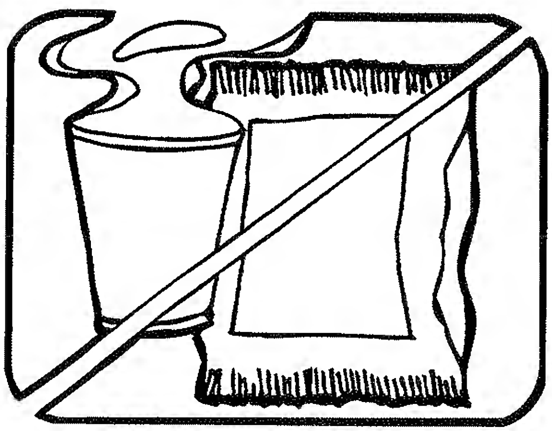
4. HANDLE S.S. DEVICES BY THE BODY.



5. USE STATIC SHIELDING CONTAINERS FOR HANDLING AND TRANSPORT.



6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE.



7. AVOID PLASTIC,VINYL AND STYROFOAM® IN WORK AREA.

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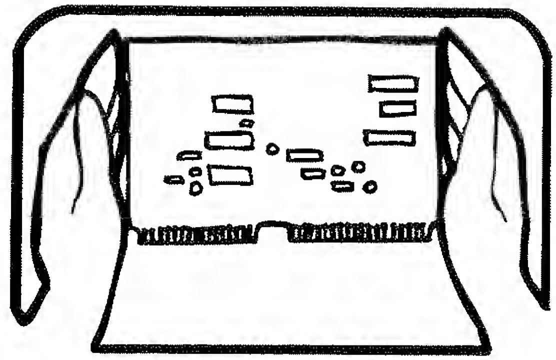
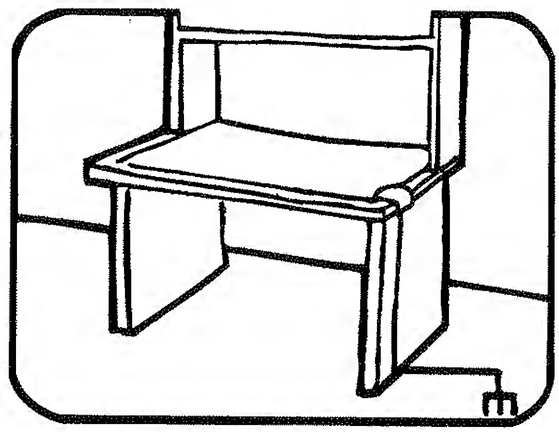
® Dow Chemical



8. WHEN REMOVING PLUG-IN ASSEMBLIES HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR HELPS PROTECT INSTALLED S.S. DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION.

10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

11. ONLY GROUNDED-TIP SOLDERING IRONS SHOULD BE USED.

Section 4
Maintenance

CONTENTS

INTRODUCTION 4-1.

This section covers procedures that do not fall into the category of troubleshooting or repair. This includes access procedures, installation of the Wideband module (Option -03), periodic cleaning, and other special service procedures.

CLEANING THE AIR FILTER 4-2.

CAUTION

Damage caused by overheating may occur if the area around the fan is restricted, the intake air is too warm, or the air filter becomes clogged.

The air filter must be removed and cleaned every 30 days or more frequently if the 5790A is operated in a dusty environment. The air filter is accessible from the rear panel.

To clean the air filter, refer to Figure 4-1 and proceed as follows:

1. Remove the filter element.
   a. Unscrew the knurled screw at the top of the air filter (counterclockwise).
   b. Pull the air filter retainer downward; it hinges at the bottom.
   c. Remove the filter element.
2. Clean the filter element.
   a. Wash the filter element in soapy water.
   b. Rinse the filter element in fresh running water.
   c. Shake out the excess water, then allow the filter element to dry thoroughly before reinstalling it.
3. Reinstall the filter element, its retainer, and the knurled screw.

GENERAL CLEANING 4-3.

To keep the 5790A looking like new, clean the case, front panel keys, and lens using a soft cloth slightly dampened with water or a non-abrasive mild cleaning solution that does not harm plastics.

CAUTION

Do not use aromatic hydrocarbons or chlorinated solvents for cleaning. They can damage the plastic materials used in the 5790A.

CLEANING PCA'S 4-4.

Printed circuit assemblies only need cleaning after repair work. After soldering on a pca, remove flux residue using isopropyl alcohol and a cotton swab.

ACCESS PROCEDURES 4-5.

WARNING

SERVICING DESCRIBED IN THIS SECTION IS TO BE PERFORMED BY QUALIFIED SERVICE PERSONNEL ONLY. TO AVOID ELECTRICAL SHOCK, DO NOT PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

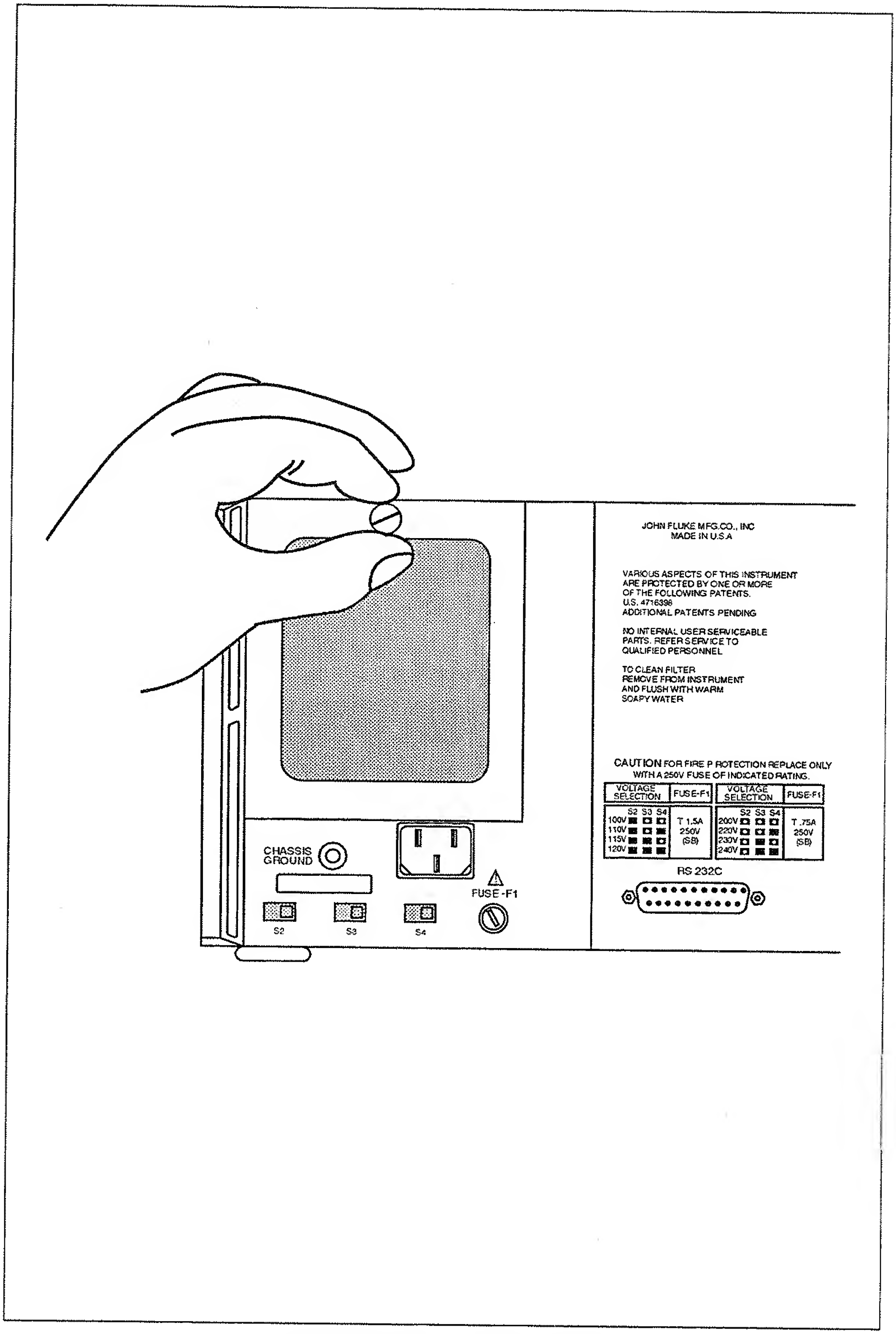


Figure 4-1. Accessing the Air Filter

Top and Bottom Covers 4-6.

Check that power is not connected to the 5790A; the power control must be off, and the line power cord must be disconnected. Top and bottom covers are each secured with eight Phillips head screws (four front, four rear).

Digital Section Cover 4-7.

The Digital Section is accessed through one top cover that is secured by six Phillips head screws.

Analog Section Covers 4-8.

The Analog Section is enclosed with separate covers on top and bottom. The top cover is secured with six Phillips head screws. The bottom Analog Section cover is secured with eight Phillips head screws (three short, five longer).

Rear Panel Removal and Installation 4-9.

Detach the Rear Panel by removing the six hex head screws (three on each rear handle side) and the two Phillips head screws found along the side of the Fan Assembly. Refer to Figure 4-2 for screw locations.

Rear Panel Assembly Access 4-10.

Refer to Figure 4-3 during the following procedure:

1. Remove the screws that secure the Rear Panel assembly housing.
2. Gently pull the rear panel housing from the Rear Panel.
3. Allow the rear panel housing to lay flat on the work surface by removing the two ribbon cables from the Rear Panel board.
4. Remove the jack screws for each connection on the rear panel housing, then gently lift the Rear Panel assembly out from the housing.

Front Panel Removal and Installation 4-11.

Refer to Figure 4-4 during the following procedure:

1. Remove the 5790A top and bottom covers.
2. Remove the single screw at the top of the Front Panel and the six hex screws on the front handle sides. Then grasp both handles and gently tilt the Front Panel down and away from the mainframe, disengaging the green power button. Position the Front Panel on its handles, in front of the instrument.
3. If you need to completely detach the Front Panel from the 5790A, you can remove the paddle board from the Analog Motherboard, or you can disconnect the input cables from the Front Panel assembly.

DISPLAY ASSEMBLY REMOVAL AND INSTALLATION 4-12.

Once the Front Panel has been removed, use the following procedure to access the Display assembly.

1. Remove the ribbon cable connecting the Display assembly to the Motherboard.
2. Remove the six screws securing the Front Panel Display assembly cover shield. Three of these screws are accessed from the inside, and the other three are accessed along the top of the front panel.
3. Remove the seven screws securing the Front Panel Display assembly to the Front Panel. Gently lift the Front Panel Display assembly up, and remove the keyboard ribbon cable. Now remove the Front Panel Display assembly.

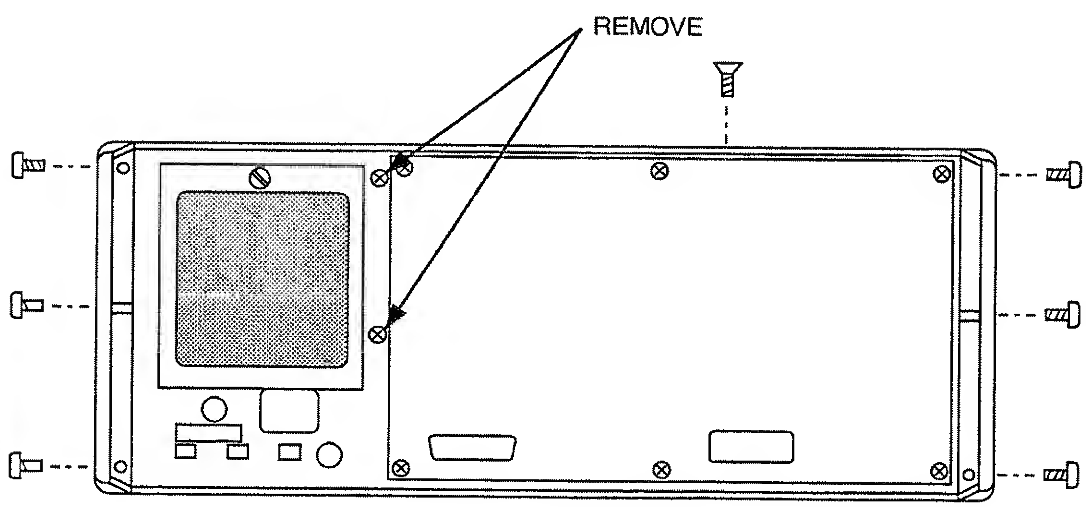
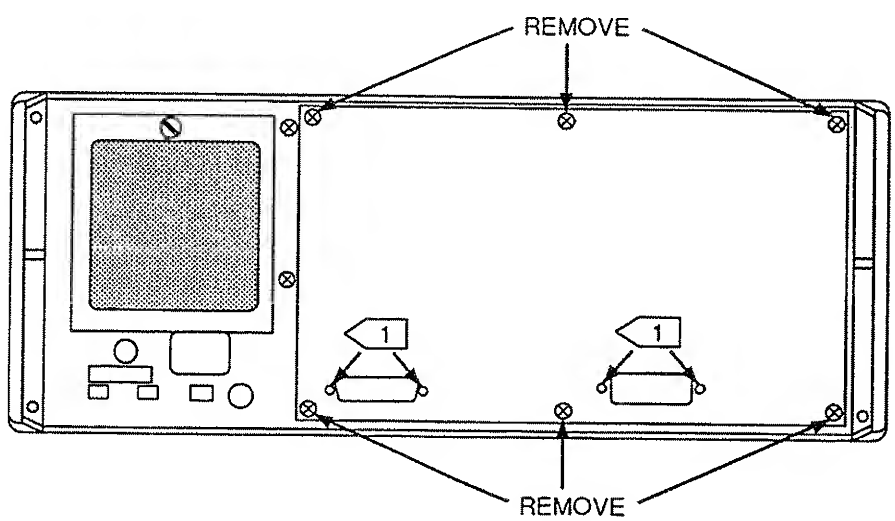


Figure 4-2. Rear Panel Removal



1 REMOVE JACK SCREWS TO SEPARATE THE REAR PANEL CIRCUIT BOARD FROM THE METAL HOUSING.

Figure 4-3. Rear Panel Assembly Access

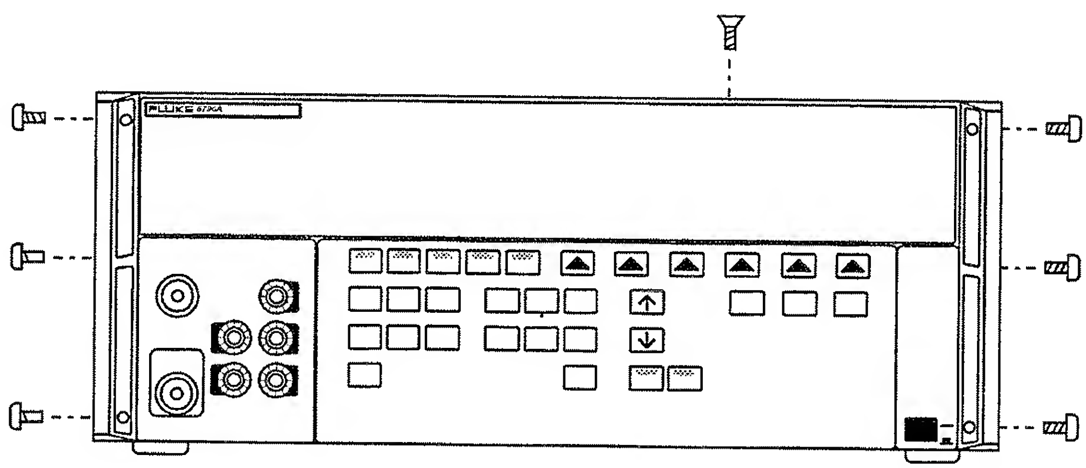


Figure 4-4. Front Panel Removal

KEYBOARD ASSEMBLY REMOVAL AND INSTALLATION 4-13.

The following procedure assumes that the Display Assembly Removal procedure has already been completed.

1. Remove all output cable connections (including GROUND-to-metal) from the front panel binding posts. Save all removed hardware.
2. Remove the two hex screws at the front of each handle. Then remove the front handles.
3. Gently release the eight plastic hook catches, and separate the front panel plastic from the sheet metal.
4. Remove the nine self-tapping screws connecting the Keyboard assembly to the front panel plastic.
5. Remove the Keyboard assembly by gently releasing the seven plastic hook catches. Work from one side of the board to the other. Start at either side by simultaneously releasing a catch and lifting on the board.

Reverse this procedure to install the Keyboard assembly. When reconnecting the wires to the binding posts, be sure to include a washer on each side of the ring terminals. Refer to the nearby decal or see sheet 4 of the Analog Motherboard schematic in Section 8 of this manual for proper connection of the output cable to the front binding posts.

CAUTION

Do not tighten the nuts that hold the wires to the binding posts more than 7 in-lb. Force exceeding 7 in-lb can destroy the binding posts.

Analog Assembly Removal and Installation 4-14.

The analog assemblies are installed in the sequence shown in Figure 4-5. Note that each module cannot be positioned in any other slot and that identifying information on the tab for each module faces forward. In all cases, the component side of each module also faces toward the front panel.

CAUTION

Do not touch any circuit area on an analog assembly. Contamination from skin oil can produce high resistance paths, with resulting leakage currents and possible erroneous readings. Always grasp an analog assembly by its upper corner ears.

Digital Assembly Removal and Installation 4-15.

Remove the CPU Assembly or the Digital Power Supply Assembly by pulling straight up at the top corners of the assembly. In relation to the chassis side, the CPU Assembly components face toward, and the Digital Power Supply Assembly components face away. See Figure 4-5.

Power Transformer Removal and Installation 4-16.

Use the following procedure to remove the Power Transformer assembly:

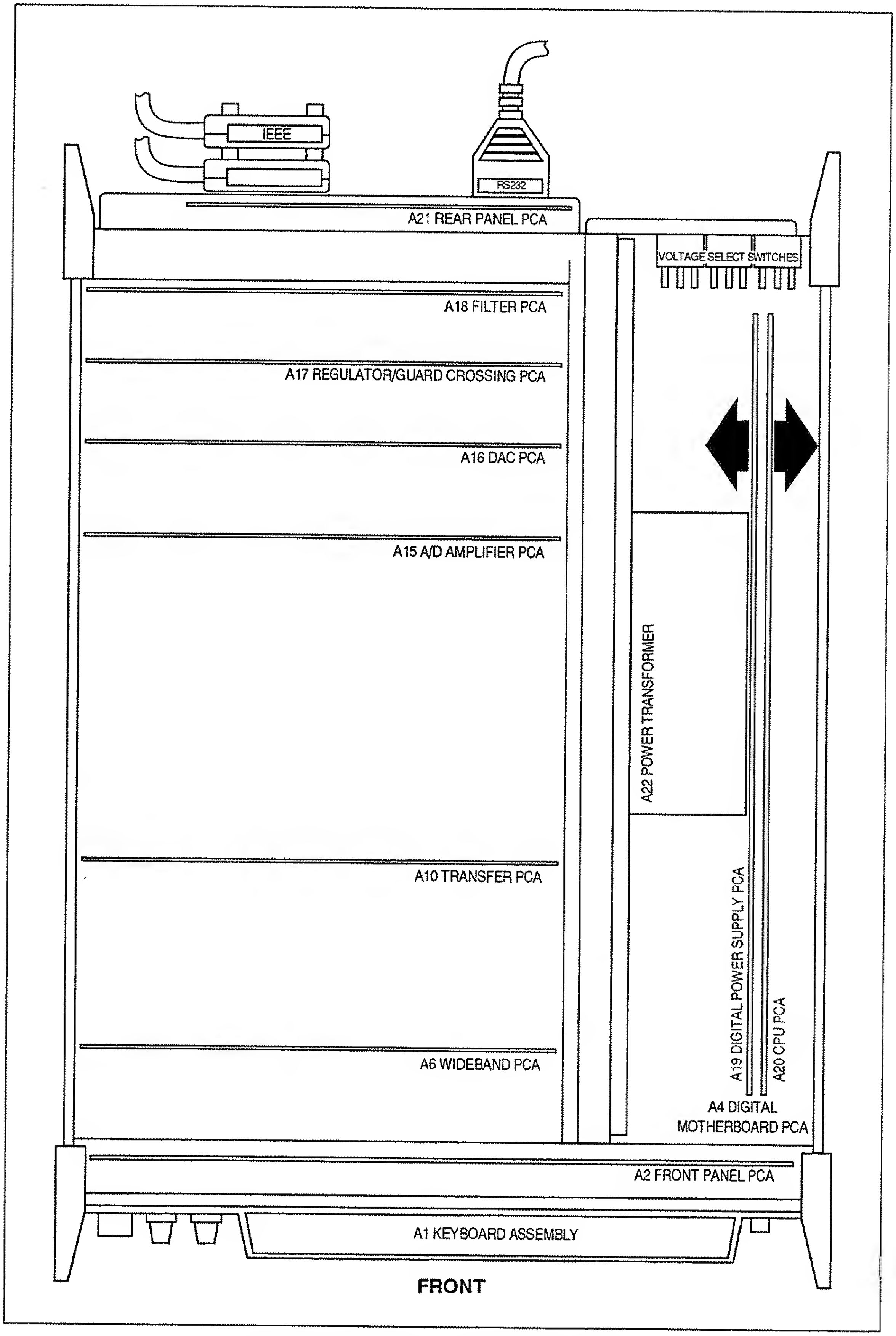


Figure 4-5. Analog and Digital Assemblies

1. Remove the 5790A Front and Rear Panels.
2. Remove the Digital Power Supply (A19) and CPU (A20) assemblies.
3. Detach the five connectors leading from the Power Transformer assembly to the Digital Motherboard. The three connectors at the rear of the assembly may not be accessible without first removing the rear fan. With the two digital assemblies (A19 and A20) removed, the four Phillips head screws securing this fan can be accessed through holes in the chassis side.

   Note that no two Power Transformer connectors are the same size and that each connector is keyed; re-connection only involves matching appropriate connectors.
4. Working from the bottom of the instrument, remove the Digital Motherboard (A4) assembly.
5. Remove the eleven screws securing the Power Transformer assembly, as follows:
   - Rear Panel: two screws, which were removed along with the Rear Panel.
   - Front Panel: two screws.
   - Top Edge: four screws.
   - Bottom Edge: three screws.
6. Remove the Power Transformer assembly.

To install the Power Transformer assembly, reverse the preceding six steps.

Hybrid Cover Removal 4-17.

When removing the plastic covers from the hybrid assemblies, push the ends of the cover retainer pins through from the back of the circuit board. The retainer pins can be damaged by attempting to pull the covers off.

INSTALLING A WIDEBAND AC MODULE (OPTION -03) 4-18.

CAUTION

THE WIDEBAND OPTION CIRCUIT BOARD ASSEMBLY CONTAINS STATIC-SENSITIVE COMPONENTS. USE CAUTION TO AVOID STATIC DISCHARGE WHEN HANDLING THE BOARD.

The procedure that follows can be used to install a 5790A-03 Wideband AC Voltage module in a 5790A. The option consists of one circuit board. This procedure is to be done only at Service Centers.

1. Remove the top and bottom covers and analog section cover as described in paragraphs 4-5 and 4-7.
2. Referring to Figure 4-5, locate the slot for the A6 Wideband Module.
3. Seat the Wideband assembly in the slot.
4. Connect the input cable supplied with the option from J1 on Wideband assembly to the front panel WIDEBAND 50Ω Type "N" connector.

CLEARING GHOST IMAGES FROM THE CONTROL DISPLAY 4-19.

After prolonged periods of displaying the same message on the Control Display, you may notice a non-uniform brightness of pixels across the display. This phenomenon can

be cleared up by lighting up the whole display and leaving it on overnight (or at least several hours). Proceed as follows to burn in the Control Display:

1. Turn on the 5790A and press the "Setup Menus" softkey.
2. Press [UTIL MENUS] followed by the "Diags" softkey.
3. Press the "Front Panel Tests" softkey.
4. Under the "Display" label, press the "Control" softkey.
5. Press the "All On" softkey. This causes all Control Display pixels to light. Press the RESET key or press PREV MENU six times to return to normal operation after an overnight or equivalent burn in period.

REPLACING THE CLOCK/CALENDAR BACKUP BATTERY 4-20.

To replace the lithium button-type battery on the CPU Assembly (A20), proceed as follows:

NOTE

After you replace the battery, the setting of the time and date the elapsed time counter (read by the remote query ETIME? and set by ETIME) will need to be reprogrammed. Query the ETIME setting before you proceed.

1. Make sure the power is off and the line power cord disconnected.
2. Follow the access procedures to remove the digital side cover.
3. Remove the CPU Assembly (A20).
4. Desolder and remove battery BT1.
5. Solder a replacement battery in place (refer to the parts list for replacement information if necessary.)

USING REMOTE COMMANDS RESERVED FOR SERVICING 4-21.

This information documents remote commands not described in the 5790A Operator Manual, Sections 5 and 6. The commands described here are useful for servicing the instrument.

Using the FATALITY? AND FATALCLR Commands 4-22.

The FATALITY? query recovers fault codes that were logged when a fatal problem occurred. These faults are logged into a separate fault queue. Once the faults are read from the queue, you can clear the queue by sending the FATALCLR command. The syntax for these remote commands are as follows:

FATALITY?

Returns the list of the fatal faults logged since the list was last cleared by the FATALCLR command. (Sequential command.)

Parameter

None.

Response

(String) The list of faults, one per line in the following format:

Example

" 8/30/91 6:33:49 Fault 4301: Rom Checksum 8/30/91 6:34:05 Fault 4301: Rom Checksum 8/30/91 6:34:12 Fault 4301: Rom Checksum 8/30/91 6:34:13 Fault 4301: Rom Checksum 8/30/91 6:34:14 Fault 4301: Rom Checksum 8/30/91 6:34:15 Fault 4301: Rom Checksum 8/30/91 6:34:16 Fault 4301: Rom Checksum "

FATALCLR?

Clears the the list of the fatal faults logged since the list was last cleared by the FATALCLR command. The list is read by the FATALITY? query. (Sequential command.)

Parameter

None.

ERROR CODES 4-23.

The 5790A error codes are listed below.

0	ERR .	No errors
1	ERR .	Error queue is full
100	CAL .	Invalide procedure number
101	CAL .	No such step in procedure
102	CAL .	No Cal/Diag procedure underway
103	CAL .	Cal/Diag not halted
104	CAL .	No cal step to which to back up
105	CAL .	No such position for range under cal
106	CAL .	No such range for cal procedure
107	CAL .	External DAC calibration failed
108	CAL .	Entered reference outside of limits
109	CAL .	Measured and entered input don't match
110	CAL .	Frequency doesn't match expected
111	CAL .	Input is of wrong polarity
112	CAL .	Input is changing during call
113	CAL .	Input tripped protection circuit
114	CAL .	Constant %s out of limits
115	CAL .	Flatness constant out of limits
116	CAL .	Range gain constant out of limits
117	CAL .	Rough gain constant out of limits
118	CAL .	Offset constant out of limits
119	CAL .	Low F constant out of limits
120	CAL .	%s range Zero out of limits
121	CAL .	%s range shunt offset out of limits
122	CAL .	Divide by zero %s IA update
123	CAL .	Old %s IA is WAY OFF! do a DC cal

124	CAL	.	Temperature gain is zero
125	CAL	.	New temperature Zero out of limits
126	CAL	.	CAL switches must be ENABLE and SERVICE
127	CAL	.	INPUT2 Correction factor out of limits
128	CAL	.	Calibration step in progress
199	CAL	.	Cal error occurred; Already reported
200	CNF	.	Need A %s to do that
201	CNF	.	Need Wideband AC option to do that
202	CNF	.	IG Software out of date: Use %s or newer
300	IG	.	A17 guardcrossing: ROM checksum
301	IG	.	A17 guardcrossing: RAM
302	IG	.	A17 Guardcrossing: DUART
303	IG	.	A17 guardcrossing: Watchdog
304	IG	.	Hardware intialization
400	DIAG	.	%s
401	DIAG	.	A16 DAC: %s channel
402	DIAG	.	%s
403	DIAG	.	A15 A/D: %s self test
404	DIAG	.	A15 A/D: %s Zero
405	DIAG	.	A15 A/D: Null DAC %s
406	DIAG	.	A15 A/D: DAC %s
407	DIAG	.	A15 A/D: Chopper %s
408	DIAG	.	A10 Transfer: %s Range
409	DIAG	.	A10 Transfer: %s Protection check
410	DIAG	.	A10 Transfer: Overload check
411	DIAG	.	A10 Transfer: Sensor input/output match
412	DIAG	.	A10 Transfer: %s Range Zero
413	DIAG	.	A10 Transfer: %s Input path
414	DIAG	.	A10 Transfer: %s Frequency measurement
415	DIAG	.	A6 Wideband: %s Range
416	DIAG	.	A6 Wideband: Overload check
417	DIAG	.	A6 Wideband: %s Frequency measurement
418	DIAG	.	A3 Motherboard: DV Divider %s
419	DIAG	.	A10 Transfer: Sensor loop settling
420	DIAG	.	A6 Wideband: Sensor loop settling
421	DIAG	.	A16 DAC: DAC settling
422	DIAG	.	A6 Wideband: Dormant protection check
423	DIAG	.	A15 A/D: %s linearity
500	STA	.	Bad Delta Unit

501	STA	.	Invalid range
503	STA	.	Can't get Ref
504	STA	.	Can't set average Ref
505	STA	.	Can't decode learned string
506	STA	.	Learned sting checksum bad
507	STA	.	Recalling unsaved instrument state
508	STA	.	Already printing a report
509	STA	.	Eternal guard not available
700	GX	.	ACK queue full
701	GX	.	Both sides of GX want to be master
702	GX	.	Both sides of GX want to be slave
703	GX	.	Couldn't ACK packet from inguard
704	GX	.	Bad packet number from inguard
705	GX	.	Multiple timeouts sending to inguard
706	GX	.	Inguard indefinite ACKWAIT holdoff
707	GX	.	Packet too large for inguard
708	GX	.	Bad ACK packet number from inguard
709	GX	.	Received invalid control byte
710	GX	.	Received invalid acknowledgement
711	GX	.	Link quality indicator below limit
712	GX	.	Inguard CPU Reset
900	NRM	.	A/D measurement failed
901	NRM	.	Protection activated
902	NRM	.	Over voltage for input
1000	NV	.	EEPROM write failed
1001	NV	.	EEPROM read checksum error (%s)
1002	NV	.	Block %s would not format
1003	NV	.	Bad NV selector %d
1004	NV	.	%d Blocks failed post-format check
1100	OPM	.	Guard crossing protocol failed to start
1101	OPM	.	Analog hardware initialization failed
1102	OPM	.	Giving up on initializing hardware
1103	OPM	.	NV Memory check found %d bad block(s)
1104	OPM	.	Analog hardware control inoperative
1300	REM	.	Bad Syntax
1301	REM	.	Unknown command
1302	REM	.	Bad parameter count
1303	REM	.	Bad keyword
1304	REM	.	Bad parameter type

1305	REM .	Bad parameter unit
1306	REM .	Bad parameter value
1307	REM .	488.2 I/O deadlock
1308	REM .	488.2 Interrupted Query
1309	REM .	488.2 Unterminated command
1310	REM .	488.2 Query after indefinite response
1311	REM .	Invalid from GPIB interface
1312	REM .	Invalid from serial interace
1313	REM .	Service Only
1314	REM .	Parameter tool long
1315	REM .	Invalid device trigger
1316	REM .	*DDT recursion
1317	REM .	Macro calls too deep
1337	REM .	Already executing a procedure
1338	REM .	Already writing to NV memory
1339	REM .	MEAS? timed-out
1360	REM .	Bad binary number
1361	REM .	Bad binary block
1362	REM .	Bad character
1363	REM .	Bad decimal number
1364	REM .	Exponent magnitude too large
1365	REM .	Bad hexadecimal block
1366	REM .	Bad hexadecimal number
1368	REM .	Bad octal number
1369	REM .	Too many characters
1370	REM .	Bad string
1500	RTC .	Invalid time
1501	RTC .	Invalid date
1502	RTC .	Can't set date, CAL STORE switch NORMAL
1602	SEQ .	Bad reply size from inguard
1603	SEQ .	False MSG semaphore from inguard
1604	SEQ .	Inguard CPU A/D error
1605	SEQ .	Inguard CPU timer out on main CPU
1606	SEQ .	Inguard CPU command error
1607	SEQ .	Timed out waiting for inguard reply
1608	SEQ .	Sequence name too long
1609	SEQ .	Element array full
1610	SEQ .	Name array full
1611	SEQ .	Already defining a sequence

1612	SEQ .	Not defining a sequence
1613	SEQ .	Command failed
1700	SER .	Bad virtual channel %d
1701	SER .	%d framing
1702	SER .	%d input queue overflow
1703	SER .	%d overrun
1704	SER .	%d Parity
1705	SER .	%d UART failed self test
1900	SYS .	Bad interrupt vect #h%02x
2100	TST .	A20 main CPU: ROM checksum
2101	TST .	A20 main CPU: RAM
2102	TST .	A20 main CPU: Real time clock
2103	TST .	A01 Keyboard: keyboard
2104	TST .	A02 Display: Output display
2105	TST .	A02 Displa: Control display
2106	TST .	A21 Rear panel: IEEE488
2107	TST .	A21 Rear panel: Rear panel DUART
2108	TST .	A20 main CPU: Guard crossing DUART
2109	TST .	A20 main CPU: Watchdog timer
2110	TST .	A20 main CPU Watchdog
2111	TST .	A2 Display: Refresh
2201	UT .	To format, set switches to ENABLE & SERVICE
2202	UT .	Can't store, CAL STORE switch NORMAL
2203	UT .	Cant' set string, CAL STORE switch NORMAL
2204	UT .	Domain error %s()
2205	UT .	Singularity %s()
2206	UT .	Overflow %s()
2207	UT .	Underflow %s()
2208	UT .	Error %s()
2209	UT .	%s
2300	WD .	Watchdog timed out (tid=%d)
65535	ERR .	Unknown error

Section 5
Troubleshooting

CONTENTS

PAGE

INTRODUCTION 5-1.

This section describes the processes that take place during power-up self tests and during diagnostics. By understanding the diagnostics test processes, error messages can provide more information.

Run self diagnostics by pressing [UTIL MENUS] followed by the "Diags" softkey. During all diagnostic procedures all the input relays are open. The instrument is disconnected from the outside world. There are no diagnostic procedures that require an external input.

When a diagnostic fault occurs during remote operation the instrument logs an error and then continues, halts, or aborts, depending on the setting of the remote command DIAGFLT. When a diagnostic fault occurs during front panel operation, the instrument halts, displays the error, and prompts the user to continue or abort diagnostics. While the instrument is in the halted state the hardware is setup per the test configuration. This allows a technician to probe the hardware.

Main CPU (A20) Power-up Tests 5-2.

The following list identifies the test name and process associated with error codes for Main CPU tests.

- *Error Code 2100: A20 Main CPU ROM Checksum,* 16-bit CRC check
- *Error Code 2101: A20 Main CPU RAM,* read/write/pattern test
- *Error Code 2110: A20 Main CPU Watchdog,* test that Watchdog goes off
- *Error Code 2107: A21 Rear Panel Rear Panel DUART,* DUART internal loopback test
- *Error Code 2102: A20 Main CPU Real Time Clock,* RTC running and valid date/time
- *Error Code 2108: A20 Main CPU Guard Crossing DUART,* DUART internal loopback test
- *Error Code 2106: A21 Rear Panel IEEE488,* GPIB interface chip
- *Error Code 2104: A2 Display Output Display,* read/write/pattern test
- *Error Code 2105: A2 Display Control Display,* read/write/pattern test

A17 Guard Crossing Processor Power-up Tests 5-3.

The following list identifies the test name and process associated with error codes for Guard Crossing Processor tests.

- *Error Code 3500: A17 Guard Crossing ROM,* checksum 16-bit CRC check
- *Error Code 3501: A17 Guard Crossing RAM,* read/write/pattern test
- *Error Code 3503: A17 Guard Crossing Watchdog,* test that watchdog goes off
- *Error Code 3502: A17 Guard Crossing DUART,* DUART internal loopback test

- *Error Code 3504: Hardware Initialization*, initialization test. The hardware initialization test is indicates the success of resetting communication with U24, setting all the virtual registers to dormant values, and setting some of the real hardware addresses to operational values.

System Startup Tests 5-4.

During power-up, the integrity of starting and maintaining a communication link with the Guard Crossing processor is done. All the nonvolatile constants are checked for CRC errors.

Diagnostic Tests 5-5.

Diagnostics start with the lowest level of hardware and work up to testing the basic functionality of each range. Diagnostics are done using no calibration information. This requires tests to have large tolerances.

In general, you should repair errors in the same sequence that they were reported. Two exceptions to this rule would be if all the digital tests failed (8255 and 8254), indicating that you should suspect the interface to guarded bus from Guard Crossing CPU or if massive analog tests fail check all the power supplies.

When the diagnostics are run in "HALT" mode, i.e. either remotely via the DIAGFLT HALT command or from the front panel, when a fault occurs the hardware is left in the test state to facility debugging by the technician.

The following list gives the test description for each step in the built-in diagnostics routine. Comments on each of the test steps are provided next in this section.

- *MAMA8255*, Motherboard 8255
- *DAC8254*, DAC 8254
- *AD8255*, A/D 8255
- *SERIAL*, A/D Serial Interface
- *ADSELFTEST*, A/D Internal Self Test
- *ADZEROS*, A/D Zeros
- *ADNULLDAC*, A/D NULL DAC
- *ADDAC*, A/D DAC Output
- *CHOPPER*, A/D Chopper
- *PROT*, Protection
- *OVLD*, Overload
- *ZEROS*, Zeros
- *DIVIDERS*, Test that 1000V and 220V dividers plugged in
- *X2_2V*, 2.2 V Range
- *X7V*, 7 V Range
- *X7VHF*, 7 V HF Range
- *X22V*, 22 V Range
- *X22VHF*, 22 V HF Range
- *X70V*, 70 V Range
- *X220V*, 220 V Range
- *X700V*, 700 V Range
- *X1000V*, 1000 V Range
- *X700MV*, 700 mV Range
- *X220MV*, 220 mV Range
- *X70MV*, 70 mV Range
- *X22MV*, 22 mV Range
- *X7MV*, 7 mV Range
- *X2_2MV*, 2.2 mV Range

- *MATCH*, Sensor Match
- *XFREQ*, Measure chopper frequency
- *LOOPFILT*, Sensor Loop

The following steps are only done if the Wideband option is installed:

- *WOVLD*, Wideband Overload
- *W7V*, Wideband 7 V Range
- *W2_2V*, Wideband 2.2 V Range
- *W700MV*, Wideband 700 mV Range
- *W220MV*, Wideband 220 mV Range
- *W70MV*, Wideband 70 mV Range
- *W22MV*, Wideband 22 mV Range
- *W7MV*, Wideband 7 mV Range
- *W2_2MV*, Wideband 2.2 mV Range
- *WFREQ*, Measure chopper frequency
- *WLOOPFILT*, Wideband Sensor Loopfilt

TEST STEP: MAMA8255 (MOTHERBOARD 8255) 5-6.

This tests the motherboard 82C55. The test proceeds as follows:

1. Set CTRL register to default value, read, and check.
2. Set A register to default value, read, and check.
3. Set B register to default value, read, and check.
4. Set C register to default value, read, and check.
5. Execute pattern write/read test on port A.

Possible errors include:

```
Error Code 3000: A3 Motherboard 8255 Control Word Test Failed
Error Code 3000: A3 Motherboard 8255 Port A Test Failed
Error Code 3000: A3 Motherboard 8255 Port B Test Failed
Error Code 3000: A3 Motherboard 8255 Port C Test Failed
```

These errors indicate a possible fault in the A3 Motherboard 8255 chip. is faulty. Note that if all the digital tests fail (8255 and 8254 tests), it is more likely that there is a problem with the guard bus interface from the A17 Guard Crossing assembly.

TEST STEP: DAC8254 (DAC 8254) 5-7.

This test checks the DAC 8254 counter. Counter 0, 1, and 2 registers are checked to see if they equal the appropriate default setting.

Possible errors include:

```
Error Code 3002: A16 DAC 8254 Counter 0 Test Failed
Error Code 3002: A16 DAC 8254 Counter 1 Test Failed
Error Code 3002: A16 DAC 8254 Counter 2 Test Failed
```

These errors suggest the A16 DAC 8254 is faulty. Note that if all the digital tests fail (8255 and 8254 tests), it is more likely that there is a problem with the guard bus interface from the A17 Guard Crossing assembly.

TEST STEP: AD8255 (A/D 8255) 5-8.

This test the A/D 82C55. It sets CTRL register to default value, reads, and verifies. The process is as follows:

1. Set A register to default value, read, and check.
2. Set B register to default value, read, and check.
3. Set C register to default value, read, and check.
4. Execute pattern write/read test on port A.

Possible errors include:

```
Error Code 3000: A15 A/D 8255 Control Word Test Failed
Error Code 3000: A15 A/D 8255 Port A Test Failed
Error Code 3000: A15 A/D 8255 Port B Test Failed
Error Code 3000: A15 A/D 8255 Port C Test Failed
```

Failure of this test suggests a bad A15 A/D 8255 chip. Note that if all the digital tests fail (8255 and 8254 tests), it is more likely that there is a problem with the guard bus interface from the A17 Guard Crossing assembly.

TEST STEP: ADSELFTEST (A/D INTERNAL SELFTEST) 5-9.

When diagnostics are first started, the communication channel with the A/D chip is restarted. If you get an Error Code 1604: Guard Crossing CPU A/D Error, suspect the serial communication hardware between the DUART on the A17 Guard Crossing assembly and U24 on the A15 A/D Amplifier assembly. This test proceeds as follows:

1. Test U24 by measuring reference and ground internally.
2. U24 measures reference internally.
3. U24 measures ground connection internally.
4. Precharge U24 filter to zero, then remeasure reference internally with filter connected.

Possible errors include:

```
Error Code 3003: A15 A/D Reference Selftest Failed
Error Code 3003: A15 A/D Reference+Filter Selftest Failed
Error Code 3003: A15 A/D Zero Selftest Failed
```

These errors indicate a possible fault on the A15 A/D Amplifier assembly. On the A15 A/D Amplifier assembly check RCOM and reference voltages. Connect the DMM LOW to the RCOM test point.

TEST STEP: ADZEROS (A/D ZEROS) 5-10.

This tests the instrumentation amplifier and A/D range zeros. The test proceeds as follows:

1. Connect both inputs of instrumentation amplifier to RCOM.
2. Measure each range, /10, /1, *10.

Possible errors include:

```
Error Code 3004: A15 A/D *100 Zero Failed
Error Code 3004: A15 A/D /1 Zero Failed
Error Code 3004: A15 A/D /10 Zero Failed
```

These errors indicate a possible fault on the A15 A/D Amplifier assembly. Referencing to the RCOM test point, check for 0V from the inputs of instrumentation amplifier to the inputs of U24.

TEST STEP: ADNULLDAC (A/D NULL DAC) 5-11.

This tests the interface and output of of the NULL DAC. The test proceeds as follows:

1. Connect NULLDAC to positive input and negative inputs of instrumentation amplifier. Program NULLDAC to output 0.0. Measure with x1 A/D range.
2. Connect NULLDAC to positive input of instrumentation amplifier, minus input to RCOM. Program NULLDAC to output 0.0. Measure with x1 A/D range.
3. Connect NULLDAC to positive input of instrumentation amplifier, minus input to RCOM. Program NULLDAC to output 1.0. Measure with x1 A/D range.
4. Connect NULLDAC to negative input of instrumentation amplifier, positive input to RCOM. Program NULLDAC to output 1.0. Measure with x1 A/D range.
5. Connect NULLDAC to negative input of instrumentation amplifier, positive input to RCOM. Program NULLDAC to output 2.0. Measure with x1 A/D range.

Possible errors include:

```
Error Code 3005: A15 A/D Null DAC -1.0 Failed
Error Code 3005: A15 A/D Null DAC -2.0 Failed
Error Code 3005: A15 A/D Null DAC 0.0 Failed
Error Code 3005: A15 A/D Null DAC 1.0 Failed
Error Code 3005: A15 A/D Null DAC NULLDAC Failed
```

These errors indicate a possible fault on the A15 A/D Amplifier assembly. Check the Null DAC reference and Null DAC output through the instrumentation amplifier input switching, then through the instrumentation amplifier to the A/D chip (U24) inputs.

TEST STEP: ADDAC (A/D DAC OUTPUT) 5-12.

Tests the DAC, DAC to DIVOUT, and DAC to DIVOUT5 outputs on A/D Amplifier assembly. This test proceeds as follows:

1. Connect DACHI to positive and negative inputs of instrumentation amplifier. Program DAC to output 0.0. Measure with x1 A/D range.
2. Connect DACHI to positive and negative inputs of instrumentation amplifier. Program DAC to output 2.0. Measure with x1 A/D range.
3. Connect DACHI to positive input of instrumentation amplifier, minus input to RCOM. Program DAC to output 0, 1.0, and 2.0. Measure with x1 A/D range.
4. Connect RCOM to positive input of instrumentation amplifier, minus input to DIVOUT. Connect DACHI to DIVOUT. Program DAC to output 1.0. Measure with x1 A/D range.
5. Connect DACHI divided by 5 to DIVOUT. Program DAC to output 10.0. Measure with x1 A/D range.

Possible errors include:

```
Error Code 3006: A15 A/D DAC DACHI 0.0 Failed
Error Code 3006: A15 A/D DAC DACHI 2.0 Failed
Error Code 3006: A15 A/D DAC DIVOUT 1.0 Failed
Error Code 3006: A15 A/D DAC DIVOUT5 2.0 Failed
```

These errors indicate a possible fault on the A15 A/D Amplifier assembly or the A16 DAC assembly. Check the A16 DAC output to A15 A/D Amplifier assembly through the instrumentation amplifier input switching, then through the instrumentation amplifier to the A/D chip (U24) inputs.

TEST STEP: CHOPPER (A/D CHOPPER) 5-13.

This tests the chopper 0 dB, 20 dB, 40 dB, and 60 dB ranges. Since the A/D can only measure dc, chopper ranges are tested by stopping the chopper in either the high or low state. With the chopper running, the A/D should measure about 0.0. This tests both the fast and slow frequency chop rates. It leaves A/D Amplifier assembly in the dormant state on exit. The test proceeds as follows:

1. Configure with DAC set to 1.0, driving DIVOUT, which drives chopper. Stop chopper with output in high state. Chopper set in 0 dB range. Route chopper output to SDL. Measure chopper output with SDL A/D range.
2. Stop chopper with output in low state. Measure chopper output with SDL A/D range.
3. Set chopper in 20 dB range. Stop chopper with output in high state. Measure chopper output with SDL A/D range.
4. Set chopper in 40 dB range. Stop chopper with output in high state. Measure chopper output with SDL A/D range.
5. Set chopper in 60 dB range. Stop chopper with output in high state. Measure chopper output with SDL A/D range.
6. Set chopper in 0 dB range. Start chopper running at slow rate. Measure chopper output with SDL A/D range. Should be about 0.
7. Use A/D to check chopper frequency at slow rate.
8. Set chopper in 0 dB range. Start chopper running at fast rate. Measure chopper output with SDL A/D range. Should be about 0.
9. Use A/D to check chopper frequency at fast rate.

Possible errors include:

```
Error Code 3007: A15 A/D Chopper 0dB High Failed
Error Code 3007: A15 A/D Chopper 0dB Low Failed
Error Code 3007: A15 A/D Chopper 20dB Failed
Error Code 3007: A15 A/D Chopper 40dB Failed
Error Code 3007: A15 A/D Chopper 60dB Failed
Error Code 3007: A15 A/D Chopper FAST Failed
Error Code 3007: A15 A/D Chopper FAST Frequency Failed
Error Code 3007: A15 A/D Chopper SLOW Failed
Error Code 3007: A15 A/D Chopper SLOW Frequency Failed
```

These errors all suggest a fault on the A15 A/D Amplifier assembly. Use an oscilloscope in addition to a DMM to troubleshoot the fault. Check the chopper input, through chopper to SDL line, to U24.

TEST STEP: PROT (PROTECTION) 5-14.

Tests part of the protection circuitry on the transfer assembly. The software can only test the section that detects multiple input relays being closed. The spark gaps that detect over voltage can not be exercised. The test proceeds as follows:

1. Program the hardware to close RLY3 (IN1 High to KV Rnet) and K3 (IN1 High to 220V Rnet).
2. Check trip status. (The relays should have tripped.)

The error from this test is:

```
Error Code 3009: A10 Transfer Protection Check Failed
```

This error indicates a fault in the protection circuit on the A10 Transfer assembly.

TEST STEP: OVLD (OVERLOAD) 5-15.

Tests the sensor input overvoltage circuitry. This test proceeds as follows:

1. Configure per 2.2V range, no inputs.
2. Set up with chopper connected to sensor.
3. Program DAC to 5.0V. Check trip status. There should be an overload indication.

The error from this test is:

```
Error Code 3010: A10 Transfer Overload Check Failed
```

This error indicates a fault in the overload circuitry on A10 Transfer assembly. The overload interrupt should toggle on and off at a slow rate as the overload detection circuitry detects sensor overheating and clamps the sensor input. When the sensor cools down the clamp circuitry releases. Check that indicated DAC voltage is at sensor input.

TEST STEP: ZEROS 5-16.

Test bottom three ranges front end amplifier zeros. The test proceeds as follows:

1. Configure instrument in 2.2 mV range with no input, use relay in front of protection SIP to short input to ground. Measure input of sensor.
2. Configure instrument in 7 mV range with no input, use relay in front of protection SIP to short input to ground. Measure input of sensor.
3. Configure instrument in 22 mV range with no input, use relay in front of protection SIP to short input to ground. Measure input of sensor.

Possible errors include:

```
Error Code 3012: A10 Transfer 2.2 mV Range Zero Failed
Error Code 3012: A10 Transfer 22 mV Range Zero Failed
Error Code 3012: A10 Transfer 7 mV Range Zero Failed
```

These errors indicate a fault on A10 Transfer assembly. Trace from short to ground through the amplifiers to the input of the rms sensor.

TEST STEP: DIVIDERS (INPUT DIVIDERS) 5-17.

Tests that the 1000V and 220V input dividers are accessible in the circuit. The test proceeds as follows:

1. Configure instrument in 1000V range with no input. Inject the chopper. Measure the input of the sensor. Close the switch that hooks up KV DIV input on the transfer board (note that a relay still keeps the input terminals open). Again measure the output of the sensor. The divider affect of the 500Ω of the input divider and the switch impedance will shift the reading.
2. Configure instrument in 220V range with no input. Inject the chopper. Measure input of sensor. Close the switch that hooks up the 220V tap on the input divider (note that a relay still keeps the input terminals open). Again measure the output of the sensor. The divider affect of the 5000Ω of the input divider and the switch impedance will shift the reading.
3. Configure instrument in 22V range with no input. Inject the chopper. Measure input of sensor. Close the switch that hooks up the 22V tap on the input divider (note that a relay still keeps the input terminals open). Again measure the output of the sensor.

The divider effect of the 500Ω input divider and the switch impedance will shift the reading.

Possible errors include:

```
Error Code 3013: A10 Transfer 22V Divider Test Failed
Error Code 3013: A10 Transfer 220V Divider Test Failed
Error Code 3013: A3 Motherboard 1000V Divider Test Failed
```

For the A3 Motherboard 1000V Divider error, the most likely problem is that the cable from the divider the motherboard is not connected. If the A10 Divider tests fail check the input switching on the A10 Transfer assembly.

TEST STEPS: X2_2V THROUGH X2_2MV 5-18.

Tests each range to the point where the chopper is injected. This test proceeds as follows:

1. Configure instrument per normal setup for range but with open input.
2. Set the DAC so that the input of the instrumentation amplifier should be 1.0. This is done by multiplying the desired A/D input by IA to reflect to input terminals and then multiply by DI to determine what the DAC setting. This implies that the input of the sensor should also be 1.0.
3. Measure sensor output with x1 A/D range. Chopper is in HIGH state (dc output). Output of sensor is feed via RCL to A/D for measuring.

Possible errors include:

```
Error Code 3008: A10 Transfer 1000V Range Failed
Error Code 3008: A10 Transfer 2.2 mV Range Failed
Error Code 3008: A10 Transfer 2.2V Range Failed
Error Code 3008: A10 Transfer 22 mV Range Failed
Error Code 3008: A10 Transfer 220 mV Range Failed
Error Code 3008: A10 Transfer 220V Range Failed
Error Code 3008: A10 Transfer 22V Range Failed
Error Code 3008: A10 Transfer 22V HF Range Failed
Error Code 3008: A10 Transfer 7 mV Range Failed
Error Code 3008: A10 Transfer 70 mV Range Failed
Error Code 3008: A10 Transfer 700 mV Range Failed
Error Code 3008: A10 Transfer 700V Range Failed
Error Code 3008: A10 Transfer 70V Range Failed
Error Code 3008: A10 Transfer 7V Range Failed
Error Code 3008: A10 Transfer 7V HF Range Failed
```

These errors indicate that a fault probably exists on A10 Transfer assembly. Trace from point where chopper is input (XF CHOP HI) through amplifiers to input of sensor to output of sensor.

TEST STEP: MATCH (Sensor Match) 5-19.

This tests that input and output sections of the rms sensor match. The test proceeds as follows:

1. Configure instrument in 2.2V range with no input.
2. Hook chopper to Transfer assembly stopped in the high state.
3. Configure DAC to output 1.0.
4. Measure output of sensor, via RCL. Connect input of sensor to RCL instead of output.

The error from this test is:

```
Error Code 3011: A10 Transfer Sensor Input/Output Match Failed
```

This error indicates a fault on A10 Transfer assembly. Check the input and output voltages on the sensor. Should both be approximately the same. If they differ, the rms sensor itself is most likely bad part.

TEST STEP: XFREQ (FREQUENCY MEASURING) 5-20.

This measure the chopper frequency via the Transfer assembly. The Transfer assembly is configured for the 2.2V range with no input.

The error from this test is:

```
Error Code 3014: A10 Transfer Frequency Measurement Failed
```

This error indicates that a fault probably exists on the A10 Transfer assembly, or less likely, on the A15 A/D Amplifier assembly. Check that the chopper (ac signal) is being transmitted to A10 Transfer assembly. Trace through the amplifiers to the input of sensor. From there the chopped reference is switched onto the COUNT motherboard line back to the A15 A/D Amplifier assembly to U24.

TEST STEP: LOOPFILT (SENSOR FILTER) 5-21.

Tests slow mode sensor loop filter settling time.

Fault 3019: A10 Transfer: Sensor Loop Settling

Transfer board configured in 1000V range, no inputs. Connect sensor output to RCL. Positive instrumentation amplifier input to RCL, negative to RCOM. Configure DAC to driver chopper. Sensor loop filter in slow mode. Set DAC to 2.0V. Let the sensor output settle. Measure sensor output with x1 A/D range. Switch chopper to be driven by DAC divided by 5 (0.4V). Let it settle. Again switch chopper to be driven by DAC directly and then immediately take 8 sample A/D reading. Compare this reading with first settled reading.

TEST STEP: WOVLD (WIDEBAND OVERLOAD) 5-22.

Tests the sensor input overvoltage circuitry.

Configure per 2.2V range, no inputs. Set up with chopper connected to sensor. Program DAC to 0.5V. Check trip status. Should indicate overload.

The error from this test is:

```
Error Code 3016: A6 Wideband Overload Check Failed
```

This error indicates that the fault is probably on A6 Wideband assembly. Check that indicated voltage (dc from chopper) appears on the A6 Wideband assembly to the input of the sensor. Check the overload detection circuitry.

TEST STEPS: W7V THROUGH W2_2MV (WIDEBAND 2.2 mV RANGE) 5-23.

Tests each range to the point where the chopper is injected. The test proceeds as follows:

1. Configure instrument per normal setup for range but with open input.
2. Set the DAC so that the input of the instrumentation amplifier should be 1.0. This is done by multiplying the desired A/D input by IA to reflect to input terminals and then multiply by DI to figure what the DAC should be set to.
3. Measure sensor output with x1 A/D range.

Possible errors include:

```
Error Code 3015: A6 Wideband 2.2 mV Range Failed
Error Code 3015: A6 Wideband 2.2V Range Failed
Error Code 3015: A6 Wideband 22 mV Range Failed
Error Code 3015: A6 Wideband 220 mV Range Failed
Error Code 3015: A6 Wideband 7 mV Range Failed
Error Code 3015: A6 Wideband 70 mV Range Failed
Error Code 3015: A6 Wideband 700 mV Range Failed
Error Code 3015: A6 Wideband 7V Range Failed
```

These errors indicate a fault on the A6 Wideband assembly. Trace from the point where the chopper comes in (WB CHOP HI), through the amplifiers, to the input of sensor.

TEST STEP: WFREQ (WIDEBAND FREQUENCY MEASURING) 5-24.

This measures the chopper frequency via the Wideband assembly.

The error from this test is:

```
Error Code 3017: A6 Wideband Frequency Measurement Failed
```

This error indicates that the fault is probably on A6 Wideband assembly. There is a slight chance the fault is on A15 A/D Amplifier assembly. Check that the chopper (ac signal) is being transmitted to the A6 Wideband assembly. Trace through amplifiers to input of sensor. From there it is routed through prescalers and filters to the COUNT motherboard line back to the A15 A/D Amplifier assembly to U24.

TEST STEP: WLOOPFILT (WIDEBAND SENSOR FILTER) 5-25.

Tests slow mode sensor loop filter settling time.

Fault 3020: A10 Wideband: Sensor Loop Settling

Transfer board configured in 7V wideband range, no inputs. Special chopper setup, 0dB attenuation. Connect sensor output to RCL. Positive instrumentation amplifier input to RCL, negative to RCOM. Sensor loop filter in slow mode. Set DAC to 70 mV. Let the sensor output settle. Measure sensor output with x1 A/D range. Switch in 40 dB attenuation in chopper. Let it settle. Again switch out the 40 dB attenuation and then immediately take 8 sample A/D reading. Compare this reading with first settled reading.

Section 6
List of Replaceable Parts

TABLE OF CONTENTS

INTRODUCTION 6-1.

This section contains an illustrated list of replaceable parts for the 5790A. Parts are listed by assembly; alphabetized by reference designator. Each assembly is accompanied by an illustration showing the location of each part and its reference designator. The parts lists give the following information:

- Reference designator
- An indication if the part is subject to damage by static discharge
- Description
- Fluke stock number
- Manufacturers supply code (code-to-name list at the end of this section)
- Manufacturers part number or generic type
- Total quantity
- Any special notes (i.e., factory-selected part)

CAUTION

A ϟ symbol indicates a device that may be damaged by static discharge.

HOW TO OBTAIN PARTS 6-2.

Electrical components may be ordered directly from the manufacturer by using the manufacturers part number, or from the Fluke Corporation and its authorized representatives by using the part number under the heading FLUKE STOCK NO. In the U.S., order directly from the Fluke Parts Dept. by calling 1-800-526-4731. Parts price information is available from the Fluke Corporation or its representatives. Prices are also available in a Fluke Replacement Parts Catalog which is available on request.

In the event that the part ordered has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

To ensure prompt delivery of the correct part, include the following information when you place an order:

- Instrument model and serial number
- Part number and revision level of the pca containing the part.
- Reference designator
- Fluke stock number
- Description (as given under the DESCRIPTION heading)
- Quantity

MANUAL STATUS INFORMATION 6-3.

The Manual Status Information table that precedes the parts list defines the assembly revision levels that are documented in the manual. Revision levels are printed on the component side of each pca.

NEWER INSTRUMENTS 6-4.

Changes and improvements made to the instrument are identified by incrementing the revision letter marked on the affected pca. These changes are documented on a supplemental change/errata sheet which, when applicable, is included with the manual.

SERVICE CENTERS 6-5.

A list of service centers is located at the end of this section.

Manual Status Information

REF OR OPTION NO.	ASSEMBLY NAME	FLUKE PART NO.	REVISION LEVEL
A1	Keyboard PCA	880687	B
A2	Front Panel PCA	885587	D
A3	Analog Motherboard PCA	885590	C
A4	Digital Motherboard PCA	885595	C
A6	Wideband PCA (Option -03)	885660	J
A6A1	RMS Support PCA	893268	D
A6A2	WB Input Protection PCA	893271	C
A10	Transfer PCA	885603	N
A10A1	Precision Amplifier PCA	893300	G
A10A2	High Voltage Protection Amplifier PCA	893305	E
A10A3	High-Gain Precision Amplifier PCA	893313	K
A15	A/D Amplifier PCA	885608	J
A16	DAC PCA	885611	B
A16A1	DAC Filter PCA	893276	C
A17	Regulator/Guard Crossing PCA	874859	D
A18	Filter PCA	885616	D
A19	Digital Power Supply PCA	885624	B
A20	CPU PCA	885629	C
A21	Rear Panel I/O PCA	885632	A

Table 6-1. Final Assembly

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
A 1	ϟ KEYBOARD PCA	880687	89536	880687	1	
A 2	ϟ FRONT PANEL PCA	885587	89536	885587	1	
A 3	ϟ ANALOG MOTHERBOARD PCA	885590	89536	885590	1	
A 4	ϟ DIGITAL MOTHERBOARD PCA	885595	89536	885595	1	
A 10	ϟ TRANSFER ASSY PCA	885603	89536	885603	1	
A 15	ϟ A/D AMPLIFIER PCA	885608	89536	885608	1	
A 16	ϟ DAC PCA	885611	89536	885611	1	
A 17	ϟ REGULATOR/GUARD CROSSING PCA	874859	89536	874859	1	
A 18	ϟ FILTER PCA	885616	89536	885616	1	
A 19	ϟ DIGITAL POWER SUPPLY PCA	885624	89536	885624	1	
A 20	ϟ CPU PCA	885629	89536	885629	1	
A 21	ϟ REAR PANEL PCA	885632	89536	885632	1	
A 22	TRANSFORMER/MODULE ASSEMBLY	813527	89536	813527	1	1
A 23	AC LINE FILTER ASSEMBLY	775445	89536	775445	1	1
A 62	INPUT BLOCK ASSEMBLY	885728	89536	885728	1	
E 401	BINDING HEAD, PLATED	102889	89536	102889	1	
F 401	FUSE,.25X1.25,1.5A,250V,SLOW	109231	71400	MDA-1 1/2	1	
F 402,403	FUSE,.25X1.25,0.75A,250V,SLOW	109256	71400	MDA-3/4	2	
H 82	NUT,EXT LOCK,STL,6-32,.344OD	152819		COMMERCIAL	1	
H 83	NUT,HEX,BR,1/4-28	110619		COMMERCIAL	1	
H 85	WASHER,LOCK,INTRNL,STL,.267ID	110817		COMMERCIAL	1	
H 101	SCREW,PH,P,LOCK,STL,8-32,.375	114124		COMMERCIAL	4	
H 301	SCREW,PH,P,LOCK,STL,6-32,.375	334458		COMMERCIAL	8	
H 302	SCREW,PH,P,LOCK,STL,4-40,.625	145813		COMMERCIAL	1	
H 303	SCREW,PH,P,LOCK,STL,6-32,.500	320051		COMMERCIAL	12	
H 305	SCREW,PH,P,THD FORM,STL,5-20,.312	494641		COMMERCIAL	9	
H 314	SCREW,PH,P,LOCK,STL,6-32,.625	412841		COMMERCIAL	1	
H 315	WASHER,FLAT,BRASS,#4,0.025	110775		COMMERCIAL	1	
H 325	SCREW,CAP,SCKT,SS,8-32,.375	295105	56878	295105	20	
H 329	SCREW,FHU,P,LOCK,SS,6-32,.250	320093	74594	320093	26	
H 332	SCREW,PH,P,LOCK,STL,6-32,.250	152140	74594	152140	47	
H 401	INSULATOR, ANALOG BOTTOM	775361	89536	775361	1	
H 414	SCREW,PH,P,LOCK,SS,6-32,.750	376822	74594	376822	14	
H 473	WASHER,FLAT,STL,.160,.281,.010	111005		COMMERCIAL	11	
H 474	SCREW,PH,P,LOCK,STL,6-32,1.250	159756	74594	159756	8	
H 523	WASHER,FLAT,STL,.191,.289,.010	111047	89536	111047	2	
MP 3	BINDING POST,STUD,PLATED	102707	89536	102707	1	
MP 19	FILTER FRAME	886390	89536	886390	1	
MP 101	GASKET	885715	89536	885715	2	
MP 103	COVER, 4R01-H	874904	89536	874904	1	
MP 104	4R01 BASE/CABLE	893321	89536	893321	1	
MP 108	ϟ RN/SUBSTRATE ASSY, 4R01	893180	89536	893180	1	
MP 301	CALIBRATION CERTIFICATION DECAL	891718	22670	891718	1	
MP 302	FRONT PANEL, MODIFIED	880737	89536	880737	1	
MP 303	LENS, SHIELD	760843	22670	760843	1	
MP 305	KEYPAD, ELASTOMERIC	874875	89536	874875	1	
MP 306	GROMMET,EXTENDED,POLYETHYLENE,.085	854351	89536	654351	0	
MP 307	LENS, DISPLAY	880752	93108	880752	1	
MP 308	NAMEPLATE, ELECTROFORM	885657	89536	885657	1	
MP 309	ADAPTER,COAX,N(F),N(M)	875443	21845	SF5097-6004	1	
MP 310	PANEL, FRONT	874883	89536	874883	1	
MP 311	SHIELD, DISPLAY PWB	880740	89536	880740	1	
MP 325	DECAL, POWER ON/OFF	886312	22670	886312	1	

Table 6-1. Final Assembly (cont)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
MP 327	DECAL, INPUT	880570	89536	880570	1	
MP 328	DECAL, KEYPAD	880526	89536	880526	1	
MP 337	HANDLE, INSTRUMENT	886333	89536	886333	4	
MP 401	SIDE EXTRUSION	886288	3X073	886288	2	
MP 402	INSERT EXTRUSION	886283	61177	886283	2	
MP 403	FOOT, RUBBER, ADHES, GRY, .44 DIA, .20 THK	358341	28213	SJ-5003	3	
MP 404	FAN/CONNECTOR ASSEMBLY	885652	89536	885652	2	
MP 406	COVER, DIGITAL	775635	89536	775635	1	
MP 407	COVER, ANALOG BOX, TOP	874920	89536	874920	1	
MP 409	COVER, ANALOG BOX, BOTTOM	874912	89536	874912	1	
MP 410	TOP COVER, INSTRUMENT	886395	89536	886395	1	
MP 411	POWER BUTTON, ON/OFF	775338	89536	775338	1	
MP 412	BOTTOM FOOT, MOLDED	868786	89536	868786	4	
MP 416	BOTTOM COVER, INSTRUMENT	886403	89536	886403	1	
MP 417	LABEL, CALIB, CERTIFICATION SEAL	802306	89536	802306	4	
MP 420	FILTER, AIR	813493	89536	813493	1	
MP 422	DECAL, CAUTION 240V	760926	22670	760926	2	
MP 447	INSULATOR, DIGITAL MOTHERBOARD	761247	89536	761247	1	
MP 454	AIDE, PCB PULL	541730	89536	541730	2	
MP 504	PANEL, REAR	874896	89536	874896	1	
MP 511	CONN ACC, MICRO-RIBBON, JACK SCREW	681940	02660	57-1912-01	2	
MP 513	CONN ACC, D-SUB, JACK SCREW, 4-40	448092	08718	D-20418-2	2	
MP 521	REAR OUTPUT HOUSING, ALUMINUM	880729	89536	880729	1	
MP 540	LABEL, ADHES, VINYL, BAR CODE, 1.500, .312	844712	22670	844712	1	
MP 543	WASHER, FLAT, SS, .119, .187, .010	853296	86928	5710-265-10-P	2	
TM 1	5790A SERVICE MANUAL	893292	89536	893292	1	
TM 2	5790A OPERATOR MANUAL	893284	89536	893284	1	
TM 3	5790A REMOTE PROGRAMMERS REF. GUIDE	893375	89536	893375	1	2
W 203	CORD, LINE, 5-15/IEC, 3-18AWG, SVT, 7.5 FT	284174	70903	17239	1	

NOTES:
ϟ Static sensitive part.
1. NON-REPAIRABLE ASSEMBLY
2. PROVIDED AS PART OF THE OPERATOR MANUAL.

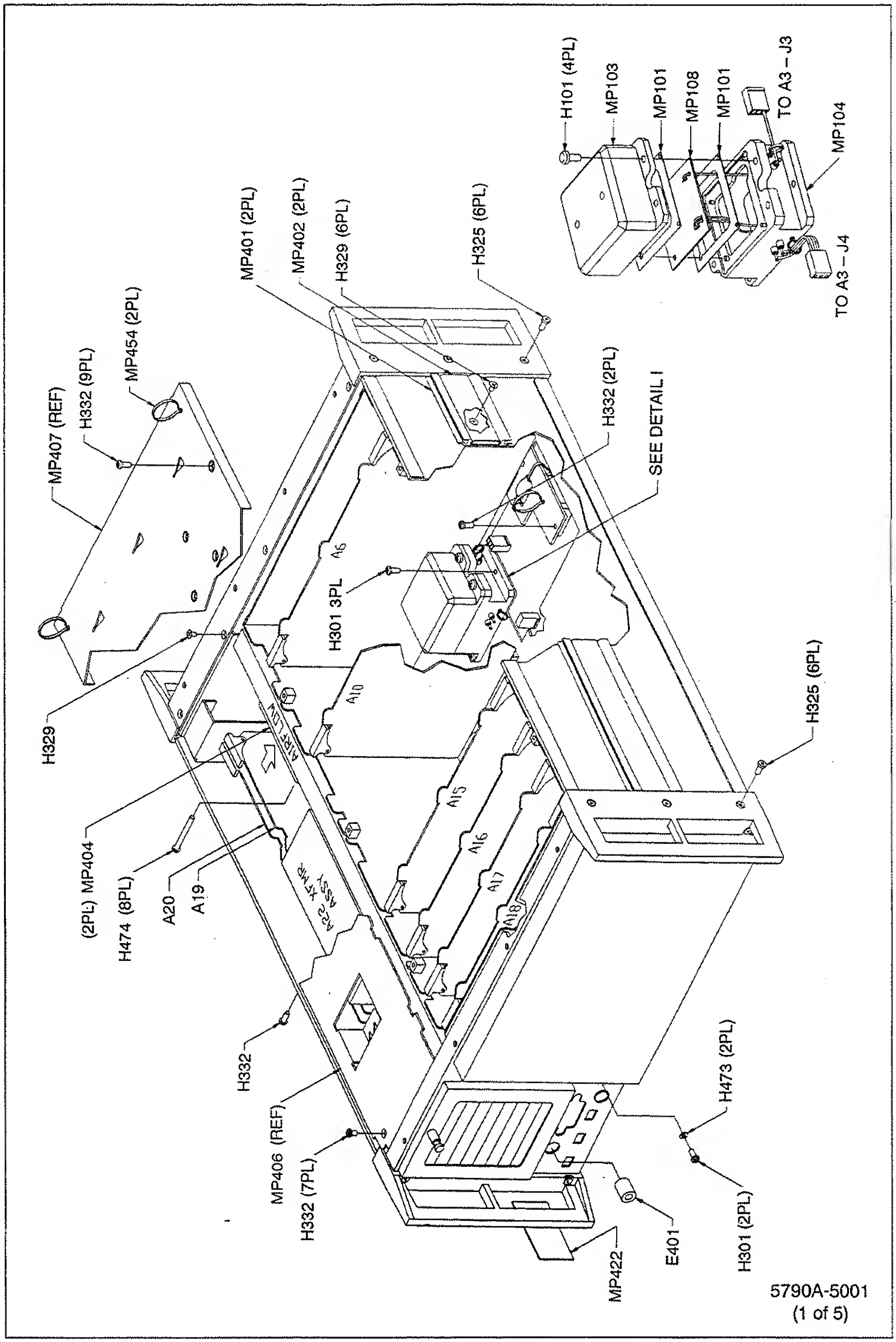


Figure 6-1. Final Assembly

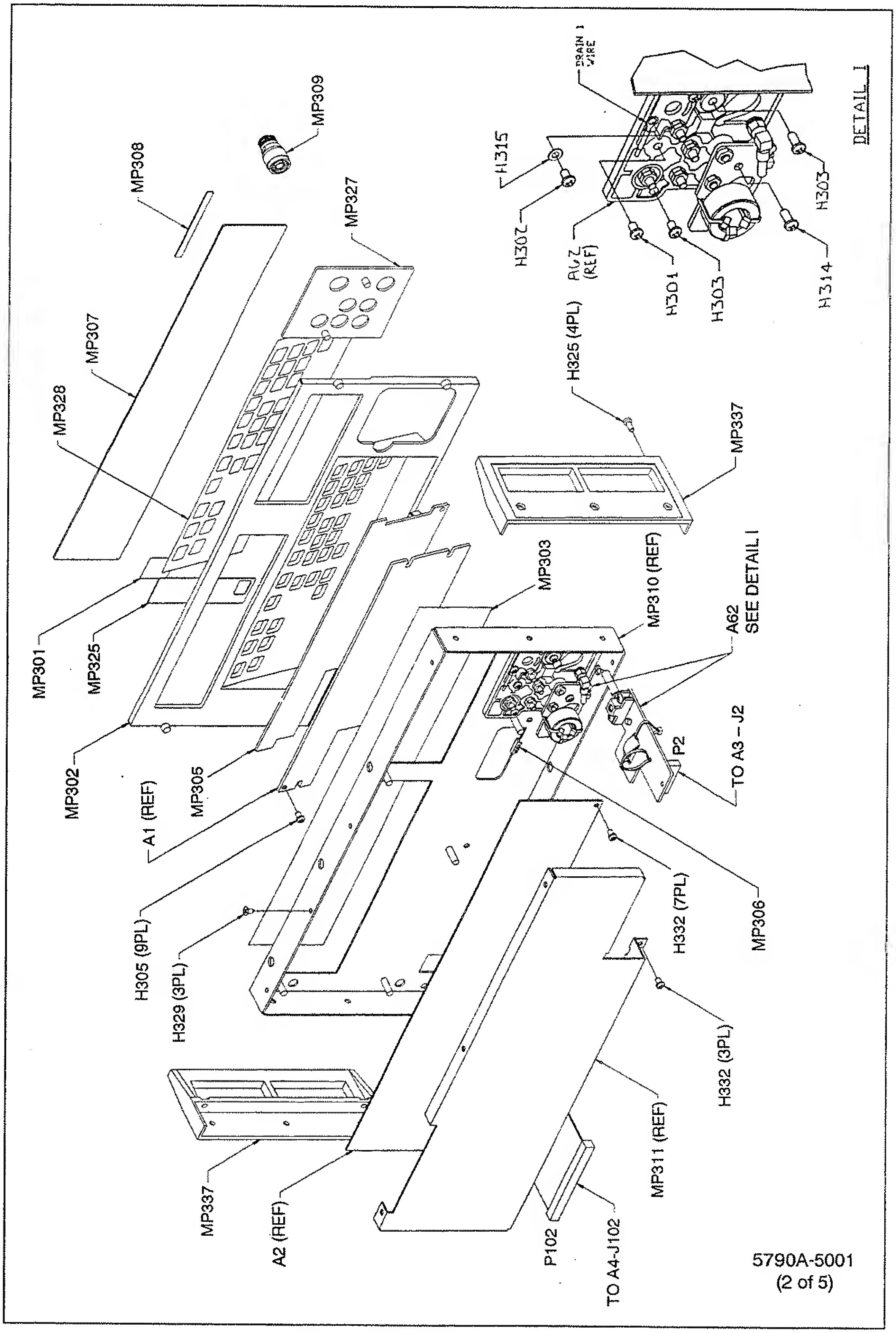
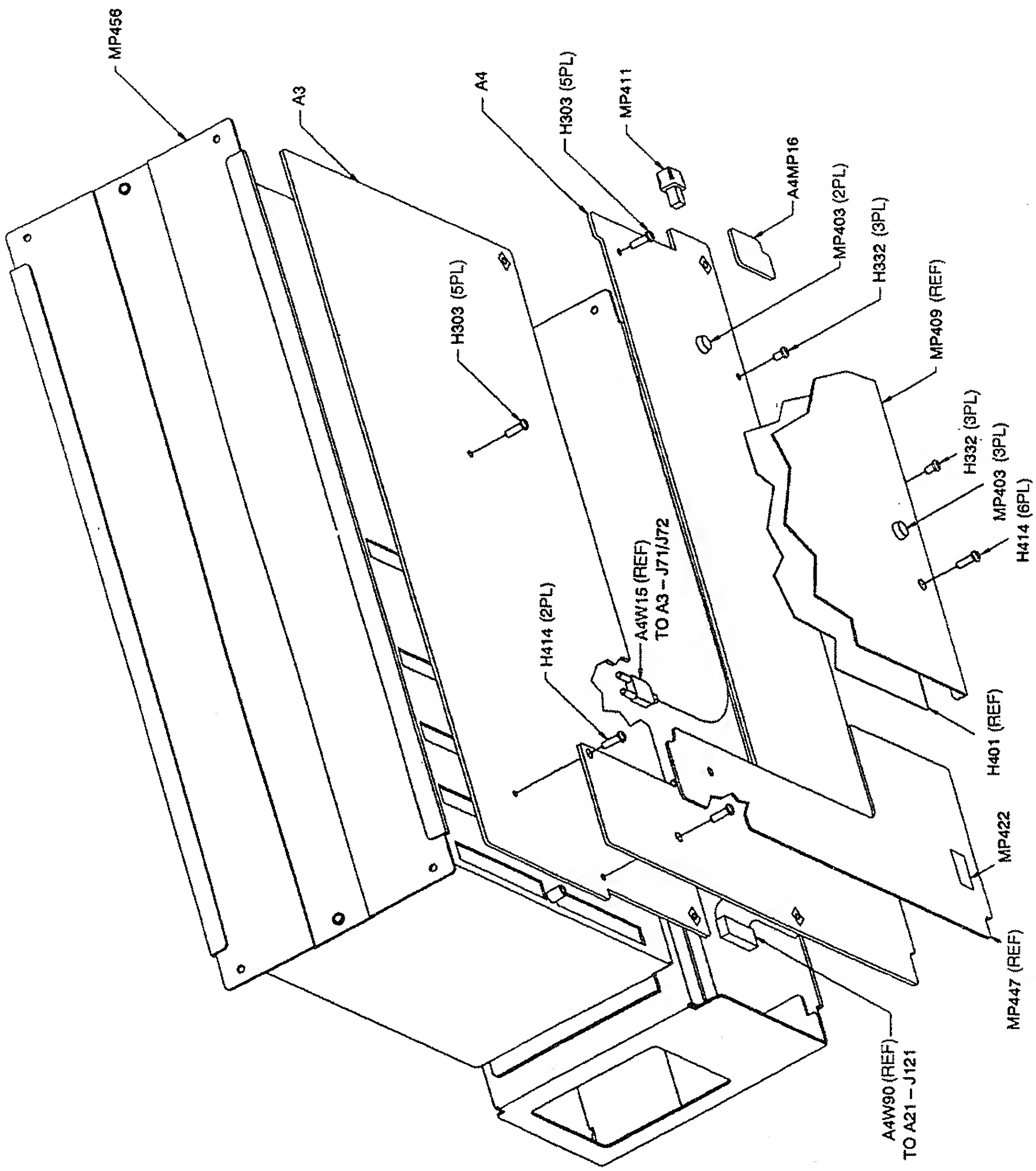


Figure 6-1. Final Assembly (cont)



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(3 of 5)

Figure 6-1. Final Assembly (cont)

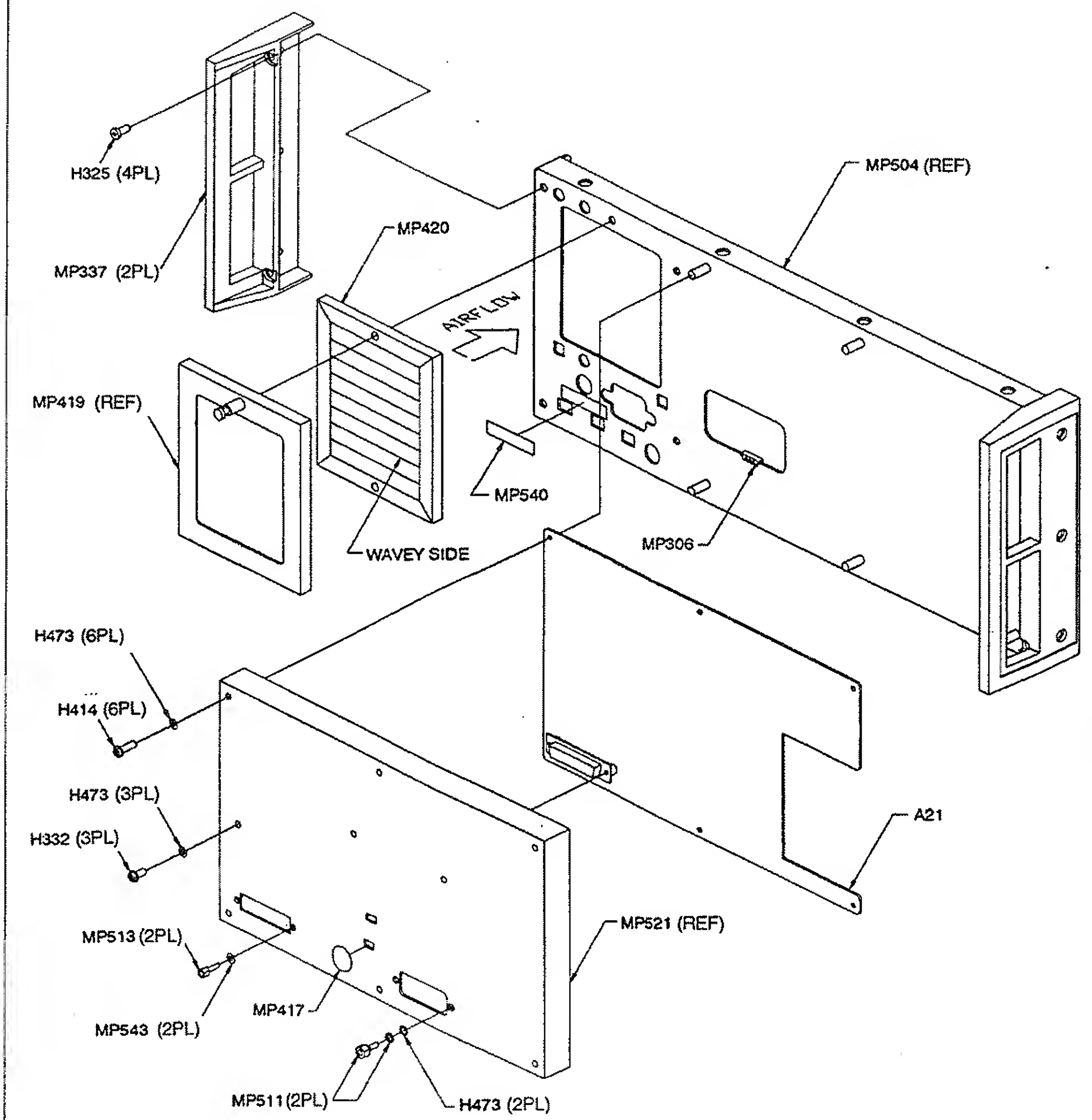

Figure 6-1. Final Assembly (cont)

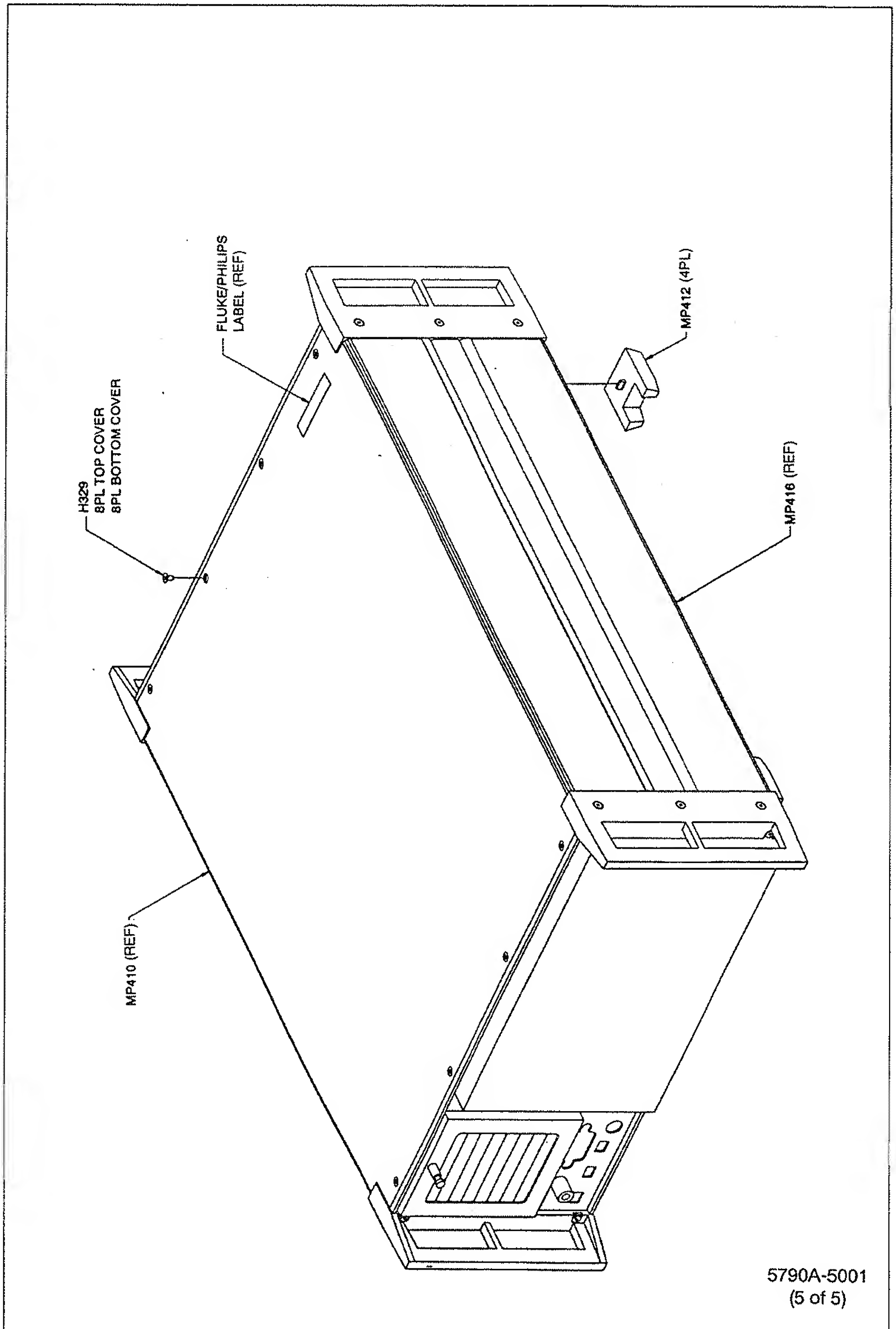

Figure 6-1. Final Assembly (cont)

Table 6-2. A62 Input Block Assembly

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1	CAP,CER,0.01UF,+-10%,100V,X7R	557587	04222	SR591C103KAA	1	
CR 1, 2	DIODE,SI,100 PIV,1.0 AMP	698555	04713	1N4002	2	
H 201	NUT, #8 LOW THERMAL	850334	20584	850334	11	
H 211	WASHER, LOW THERMAL #8	859939	22670	859939	6	
H 217	CABLE ACCESS,TIE,4.00L,.10W,.75 DIA	172080	06383	SST-1M	9	
H 222	SCREW,PH,P,THD FORM,STL,5-20,.312	494641		COMMERCIAL	1	
H 223	TERM,RING,#6,26-22AWG,CRIMP,GOLD	832667	00779	1-331401-2	1	
H 226	SPACER,SWAGE,.250 RND,BR,6-32,.375	877019	55566	3049-C-632-B-14	2	
H 228	SCREW,TH,P,SS,6-32,.312	335174		COMMERCIAL	2	
H 230	STUD,BROACH,PH BRNZ,8-32,.312	876409	46384	KFH-832-5	1	
H 231	SPACER,SWAGE,.250 RND,BR,.140,.125	905351	55566	1531C-6-B-14	1	
H 232	WIRE,TEF,UL1180,22AWG,STRN,RED	115576	23172	2875-3	1	
H 234	AIDE,PCB PULL	541730	89536	541730	1	
H 235	SLEEV,POLYOL,SHRINK,.125-.062ID,BLACK	149450	28213	FPVW-301-1/8BLK	1	
H 237	SPACER,.250 RND,AL,.156ID,.250	153155	55566	11248A7	1	
MP 201	INPUT BLOCK, MOLDED	880724	89536	880724	1	
MP 202	CORE,TOROID,FERRITE,28X16X13MM	474908	54583	H5C2-T28-13-16	1	
MP 203	PWB, INPUT BLOCK	885637	89536	885637	1	1
MP 204	WIDEBAND CONNECTOR	893193	89536	893193	1	
MP 206	SLEEV,POLYOL,SHRINK,.046-.023ID,BLACK	144410	28213	FPVW-301-3/64BLK	1	
MP 222	BINDING POST-RED	886382	89536	886382	2	
MP 224	BINDING POST-BLUE	886366	89536	886366	1	
MP 225	BINDING POST-GREEN	886374	89536	886374	1	
MP 226	BINDING POST-BLACK	886379	89536	886379	1	
P 2	SOCKET,1 ROW,PWB,.156CTR,8 POS	886820	95354	3000-208-2107	1	
W 201	CABLE, FRONT INPUT	893198	89536	893198	1	
W 202	CABLE, WIDEBAND	893201	89536	893201	1	
NOTES:	ϟ Static sensitive part. 1. CONSISTS OF A22, A23, AND A24 PWB'S					

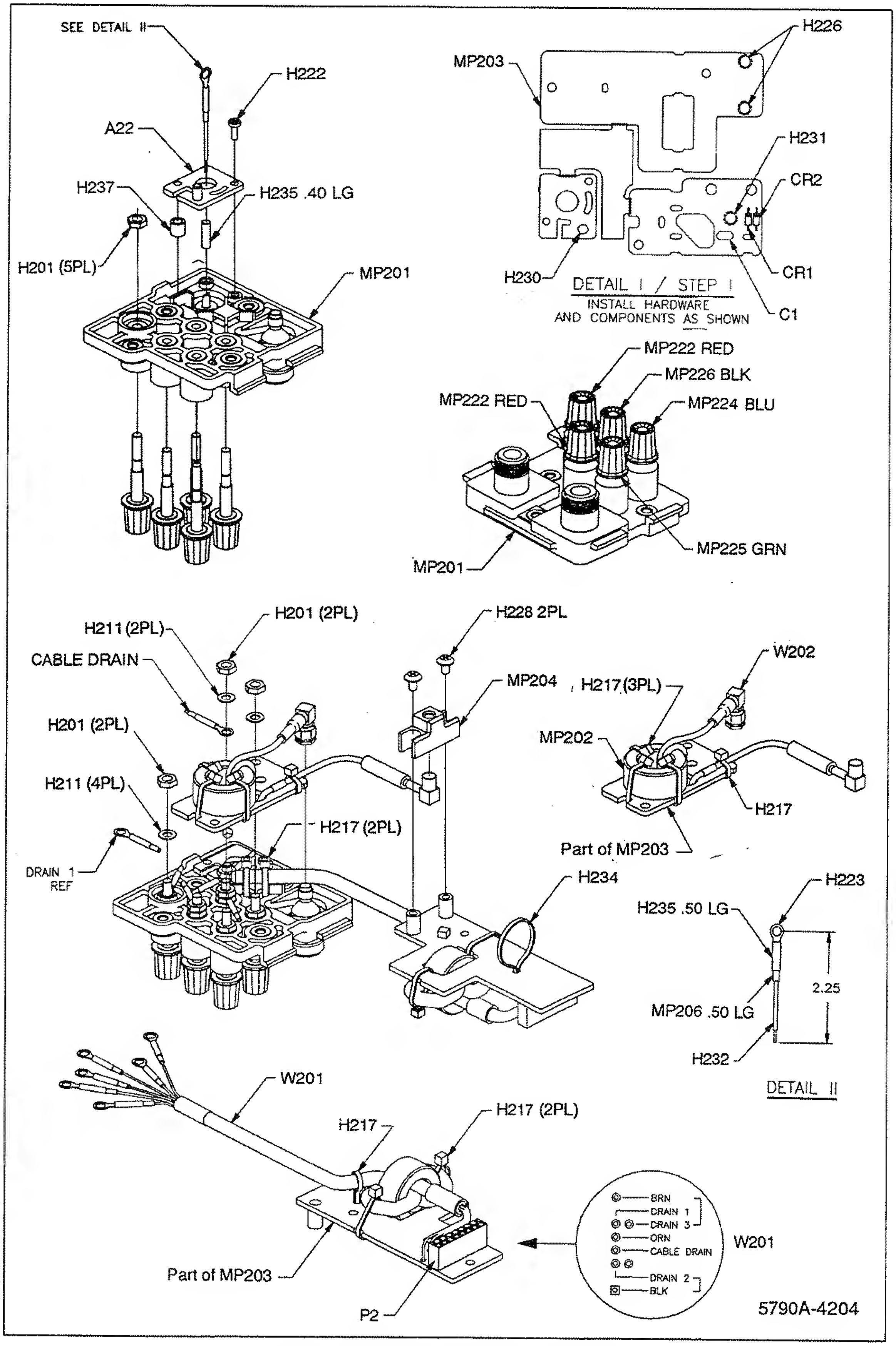

Figure 6-2. A62 Input Block Assembly

Table 6-3. A1 Keyboard PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
CR 1- 6	LED, GREEN, SUBMINIATURE, 20 MCD	912241	26402	SSL-LXA223GC	6	
W 1	CABLE, KEYBOARD/REAR PANEL	802710	89536	802710	1	
NOTES:	ϟ Static sensitive part.					

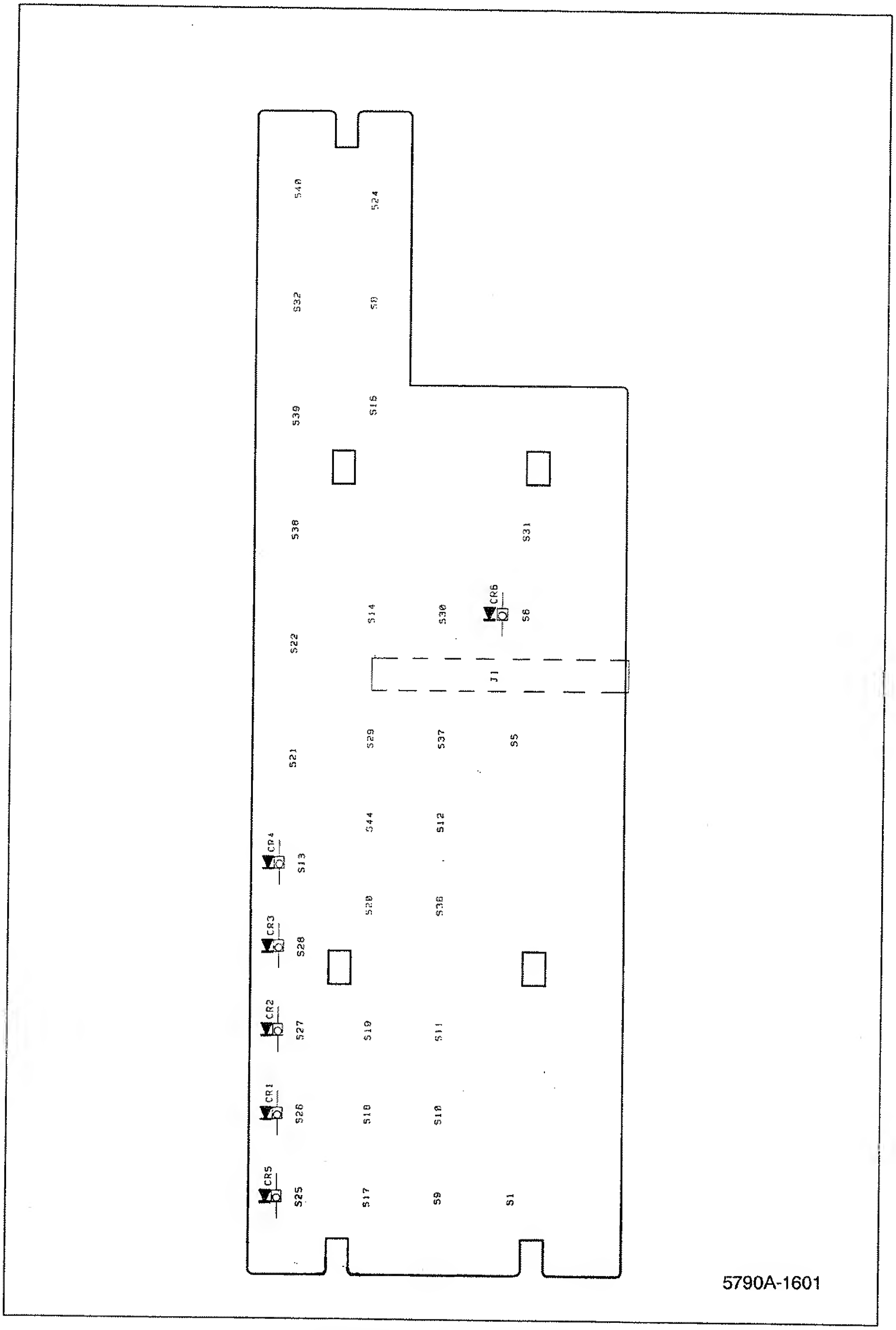

Figure 6-3. A1 Keyboard PCA

Table 6-4. A2 Front Panel PCA

REFERENCE DESIGNATOR		DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1		CAP,TA,47UF,+-20%,10V	746990	56289	195D476X0010H2B	1	
C 2, 4, 9- C 20, 28, 30, C 35, 37, 39- C 46, 64		CAP,CER,0.1UF,+-10%,25V,X7R,1206	747287 747287 747287 747287	04222	12063C104KAT060B	27	
C 3, 21- 27, C 29, 31, 36, C 38, 47- 50, C 66		CAP,TA,10UF,+-20%,25V	772491 772491 772491 772491	56289	195D106X0025G2B	17	
C 5, 33, 65		CAP,TA,1.5UF,+-20%,50V	780478	56289	195D155X0050F2B	3	
C 6, 8, 32, C 34, 51- 54		CAP,CER,0.01UF,+-20%,100V,X7R,1206	742981 742981	04222	12061C103MA1050B	8	
C 7		CAP,AL,10UF,+-20%,100V,SOLV PROOF	820738	62643	KME100T10RM6X16LL	1	
C 55- 62		CAP,POLYES,0.68UF,+-20%,100V,Z5U,2225	912506	68919	MKS684M100	8	
C 63		CAP,CER,100PF,+-10%,50V,C0G,1206	740571	04222	12065A101KAT050B	1	
DS 1		TUBE, DISPLAY, VAC FLOR,2-ROW,22-CHAR	806976	0BW21	CP2215	1	
DS 2		TUBE,DISPLAY,VAC FLUOR,256X26 GRAPHIC	832543	0BW21	DM256X26GB	1	
J 2		HEADER,2 ROW,.100CTR,40 PIN	807453	59730	501-4027ES	1	
M 1- 10		FOOT,RUBBER,ADHES,BLK,.50 SQ,.12 THK	543488	28213	SJ-5008	10	
Q 1- 4, 7- Q 10	ϟ ϟ	TRANSISTOR,SI,PNP,SMALL SIGNAL,SOT-23	742023 742023	73445	BCX17TRL	8	
Q 5, 6, 11, Q 12	ϟ ϟ	TRANSISTOR,SI,NPN,SMALL SIGNAL,SOT-23	742031 742031	8A233	BCX19TRL	4	
R 1, 3, 5, R 6, 8, 10- R 12, 20, 28- R 30, 55- 59, R 61, 63, 65, R 72, 76	ϟ ϟ ϟ ϟ ϟ ϟ	RES,CERM,4.7K,+-5%,.125W,200PPM,1206	740522 740522 740522 740522 740522 740522	91637	CRCW1206-4701JB	22	
R 2, 4, 7, R 9, 40, 41, R 52, 53	ϟ ϟ ϟ	RES,CERM,1.1K,+-5%,.125W,200PPM,1206	746008 746008 746008	91637	CRCW1206-1101JB	8	
R 13- 15, 24, R 25, 70, 73- R 75	ϟ ϟ ϟ	RES,CERM,39K,+-5%,.125W,200PPM,1206	746677 746677 746677	91637	CRCW1206-3902JB	9	
R 16- 19, 78- R 80	ϟ ϟ	RES,CERM,150,+-1%,.125W,100PPM,1206	772780 772780	91637	CRCW1206-1500FB	7	
R 22, 26, 39, R 42, 51, 54	ϟ ϟ	RES,CERM,6.8K,+-5%,.125W,200PPM,1206	746024 746024	91637	CRCW1206-6801JB	6	
R 23, 27, 71	ϟ	RES,CERM,82K,+-5%,.125W,200PPM,1206	811794	91637	CRCW1206-8202JB	3	
R 31- 34, 43- R 46, 60, 62, R 64, 66	ϟ ϟ ϟ	RES,CERM,1K,+-5%,.125W,200PPM,1206	745992 745992 745992	91637	CRCW1206-1001JB	12	
R 35, 36, 68	ϟ	RES,CERM,620,+-5%,.125W,200PPM,1206	745984	91637	CRCW1206-6200JB	3	
R 37, 38	ϟ	RES,CERM,470,+-5%,.125W,200PPM,1206	740506	91637	CRCW1206-4700JB	2	
R 47, 48	ϟ	RES,CERM,453,+-1%,.125W,100PPM,1206	801415	91637	CRCW1206-4530FB	2	
R 49, 50	ϟ	RES,CERM,1.5K,+-5%,.125W,200PPM,1206	746438	91637	CRCW1206-1501JB	2	
R 67	ϟ	RES,CERM,200,+-5%,.125W,200PPM,1206	746339	91637	CRCW1206-2000JB	1	
R 77	ϟ	RES,CERM,91,+-5%,.125W,200PPM,1206	756338	91637	CRCW1206-91R0JB	1	
R 81, 82	ϟ	RES,CERM,10,+-5%,1W,200PPM,2512	886705	55637	MC2512-10OHM-5%T	2	
R 83	ϟ	RES,CERM,200,+-5%,.5W,200PPM,2010	886952	91637	RCWP2010-201J	1	
SP 1		AF TRANSD,PIEZO,24 MM	602490	51406	PKM24-4A1	1	
U 1, 2	ϟ	IC,NMOS,1K X 8 DUAL PORT SRAM,PLCC	806653	34335	AM2130-10JC	2	
U 3	ϟ	IC,CMOS,900 GATE PLD,5700A-90720,PLCC	838607	89536	838607	1	
U 4	ϟ	IC,CMOS,900 GATE PLD,5700A-90721 PLCC	838615	89536	838615	1	
U 5	ϟ	IC,CMOS,900 GATE PLD,5700A-90722,PLCC	845375	89536	845375	1	
U 6	ϟ	IC,CMOS,14 STAGE BINARY COUNTER,SOIC	831081	04713	MC74HC4060DR1	1	
U 7	ϟ	IC,COMPARATOR,DUAL,HIGH SPEED,SOIC	831271	18324	NE522DT	1	
U 8	ϟ	IC,CMOS,12 STAGE BIN RIPPLE CNTR,SOIC	831636	18324	74HC4040DT	1	
U 9	ϟ	IC,CMOS,900 GATE PLD,5700A-90723,PLCC	845383	89536	845383	1	
U 10	ϟ	IC,LSTTL,OCTL D TRNSPRNT LATCHES,SOIC	742726	01295	SN74LS373DR	1	

Table 6-4. A2 Front Panel PCA (cont)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
U 11	ϟ IC,CMOS,HEX INVERTER,SOIC	742585	18324	N74HCT040	1	
U 12	ϟ IC,CMOS,DUAL D F/F,+EDG TRG,SOIC	782995	01295	SN74HC74DR	1	
U 13	ϟ IC,TTL,HEX INVERTER,W/OPEN COLL,SOIC	741249	18324	N7406DT	1	
U 14- 23	ϟ IC,BIMOS,DISPLAY DRIVER,80V,PLCC	741231	56289	5818EPF-1	10	
U 24	ϟ IC,CMOS,600 GATE PLD,5700A-90724,PLCC	837369	89536	837369	1	
VR 3, 4	ϟ ZENER,UNCOMP,6.2V,10%,60.5MA,1.5W,MLF	886700	14552	MLL5920B	2	
VR 5	ϟ ZENER,UNCOMP,5.1V,5%,20MA,0.2W,SOT-23	837179	04713	MMBZ5231BT1	1	
W 1	CABLE, MOTHER BD TO DISPLAY	802694	89536	802694	1	
NOTES:	ϟ Static sensitive part.					

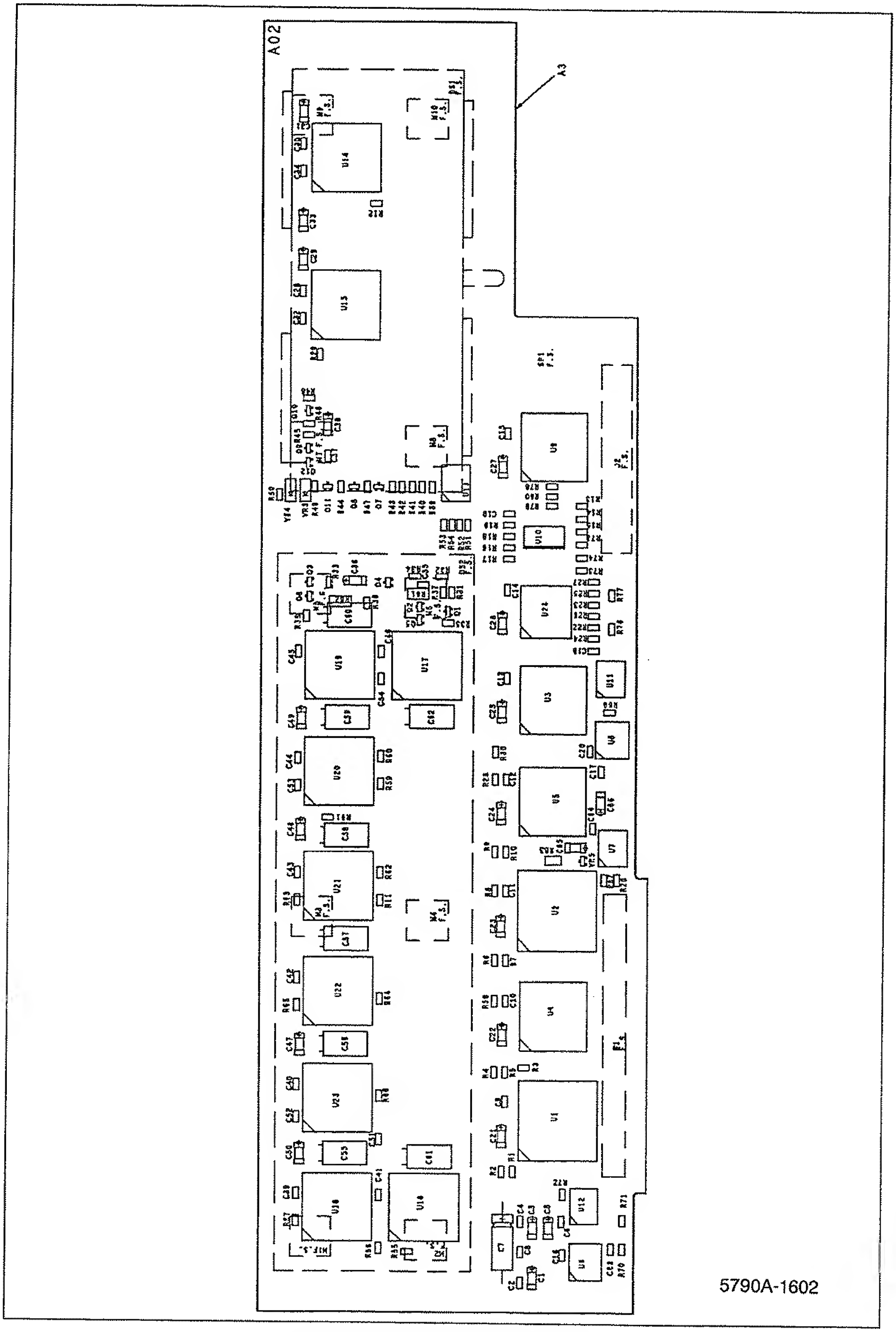

Figure 6-4. A2 Front Panel PCA

Table 6-5. A3 Analog Motherboard PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1, 3	CAP,POLYES,0.1UF,+-10%,50V	649913	37942	185-2-104K50AA	2	
C 4	CAP,TA,22UF,+-20%,25V	845149	56289	199D226X0025DG2	1	
C 5	CAP,POLYES,0.001UF,+-10%,50V	720938	37942	185-2-112K50AA	1	
C 6, 7	CAP,CER,33PF,+-5%,50V,C0G	714543	04222	SR595A330JAA	2	
CR 1- 4	DIODE,SI,RECT,BRIDGE,BV=50V,IO=1A	418582	14936	DF005M	4	
E 1	SURGE PROTECTOR,90V,+40 -0	198507	25088	B1-F90	1	
H 1, 2	SPACER,SWAGE,.250 RND,BR,6-32,.625	877063	55566	3053-C-632-B-14	2	
H 3- 5	SPACER,SWAGE,.250 RND,BR,6-32,.375	877019	55566	3049-C-632-B-14	3	
H 7- 20	CONN ACC,DIN41612,KEY	832733	28213	3435-1	14	
J 2	HEADER,1 ROW,.156CTR,8 PIN	886812	27264	26-60-2080	1	
J 3	HEADER,1 ROW,.156CTR,3 PIN	380022	00779	640388-3	1	
J 4	HEADER,1 ROW,.156CTR,2 PIN	641647	00779	640388-2	1	
J 71	FIBER OPTIC,RECEIVER,1MBD	822148	28480	HFBR-2522	1	
J 72	FIBER OPTIC,TRANSMITTER,1MBD	822155	28480	HFBR-1521	1	
J 106,110,113, J 115-118,206, J 210,213,215- J 218	CONN,DIN41612,TYPE C,64 SCKT	807818 807818 807818 807818	28213	7364-60D3TB	14	
J 811,812,821, J 822	SOCKET,1 ROW,PWB,.156CTR,10 POS	851183 851183	27264	26-01-1108	4	
K 1- 4	RELAY,ARMATURE,2 FORM C,4.5 V,SEALED	875638	26806	AZ2429-217-201	4	
K 7	RELAY,ARMATURE,2 FORM C,5VDC	876854	33297	EA2-5NJ	1	
MP 1- 28	RIVET,S-TUB,OVAL,STL,.087,.250	838482	40551	502-.087-.250	28	
R 1, 3	RES,CF,750,+-5%,0.25W	573162	59124	CF1/4 751J	2	
R 2	RES,CF,91,+-5%,0.25W	441683	59124	CF1/4 910J	1	
R 4	RES,CF,16K,+-5%,0.25W	641118	59124	CF1/4 163J	1	
U 1	ϟ IC,CMOS,PROGRMBL PERIPHERAL INTERFACE	780650	34371	CP82C55A	1	
VR 1, 2	ϟ ZENER,UNCOMP,12V,5%,100MA,5W	876862	04713	1N5349B	2	
XU 1	SOCKET,IC,40 PIN	429282	00779	2-640379-1	1	
Z 1	RES,CERM,SIP,10 PIN,9 RES,3K,+-2%	501528	91637	CSC10A-01-302	1	
Z 2	RES,CERM,SIP,6 PIN,5 RES,10K,+-2%	500876	91637	CSC06A-01-103G	1	
NOTES:	ϟ Static sensitive part.					

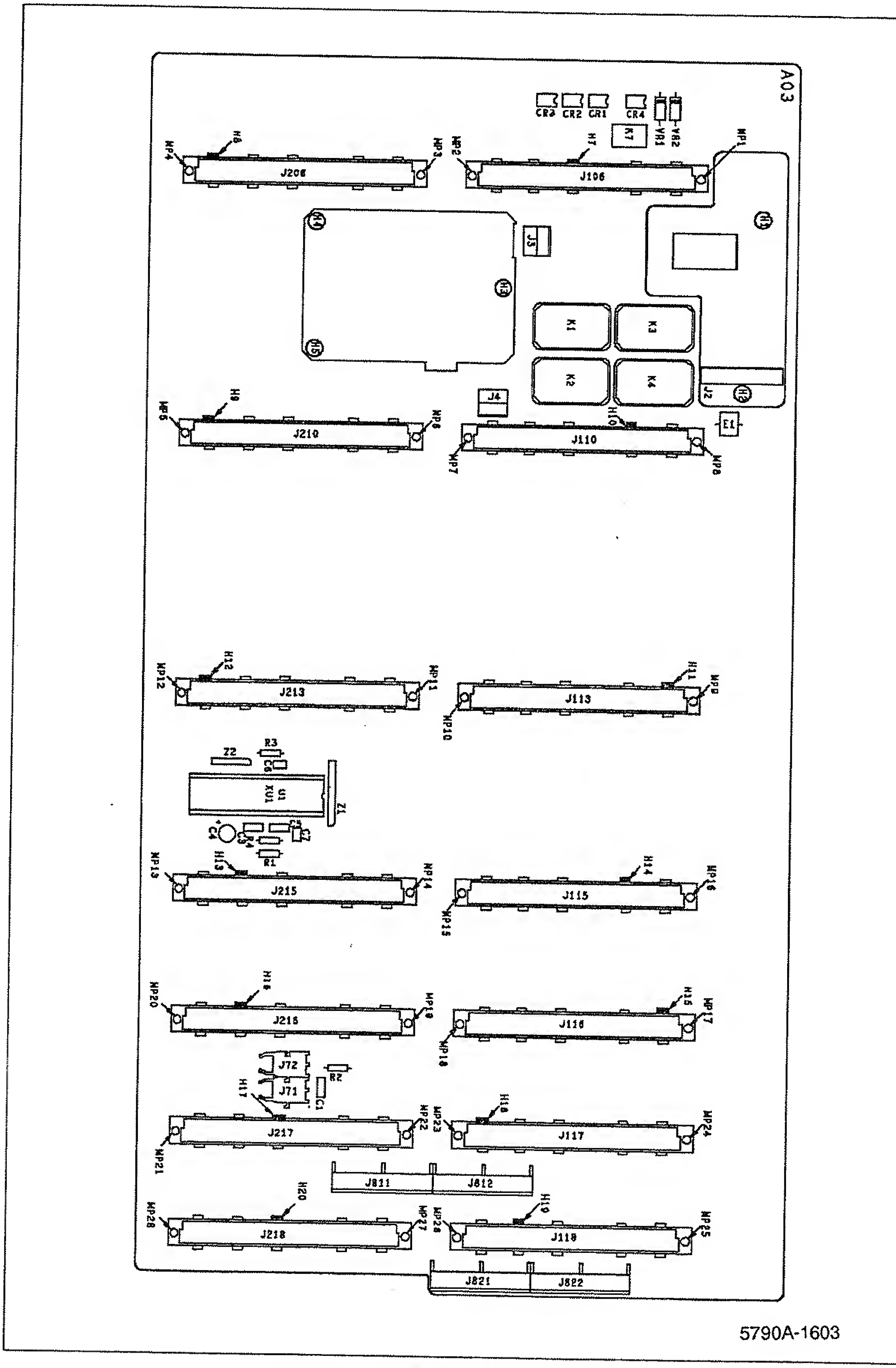

Figure 6-5. A3 Analog Motherboard PCA

Table 6-6. A4 Digital Motherboard PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1, 4	CAP,TA,10UF,+-20%,35V	816512	56289	199D106X0035DG2	2	
C 3	CAP,POLYES,0.1UF,+-10%,50V	649913	37942	185-2-104K50AA	1	
C 5	CAP,POLYES,0.1UF,+-20%,250VAC	542233	37942	158.00-104250VAC	1	
C 6	CAP,CER,6800PF,+-5%,100V,C0G	816710	04222	SR591A682JAA	1	
CR 1, 2	DIODE,SI,RECT,BRIDGE,BV=50V,IO=1A	418582	14936	DF005M	2	
CR 3, 4	DIODE,SI,100 PIV,1.0 AMP	698555	04713	1N4002	2	
F 1	FUSE,.25X1.25,1.5A,250V,SLOW	109231	71400	MDA-1 1/2	1	
H 1, 2	RIVET,S-TUB,OVAL,STL,.087,.343	838458	40551	502-.087-.343	2	
H 3- 5	CONN ACC,DIN41612,KEY	832733	28213	3435-1	3	
H 6, 7	WASHER,FLAT,STL,.093,.219,.020	306415		COMMERCIAL	2	
H 8- 14	CABLE ACCESS,TIE,4.00L,.10W,.75 DIA	172080	06383	SST-1M	7	
H 15- 17	SPACER,BROACH,SNAP,AL,.187	820639	46384	YA7-6359	3	
H 19, 20	SCREW,PH,P,LOCK,SS,4-40,.187	149567	74594	149567	2	
J 11	HEADER,1 ROW,.156CTR,12 PIN	831354	00779	1-640388-2	1	
J 13	HEADER,1 ROW,.156CTR,10 PIN	446724	00779	1-640388-0	1	
J 14	HEADER,1 ROW,.156CTR,16 PIN	831370	00779	1-640388-6	1	
J 15	HEADER,1 ROW,.156CTR,14 PIN	831362	00779	1-640388-4	1	
J 16	HEADER,1 ROW,.156CTR,8 PIN	385435	00779	1-640388-8	1	
J 31	HEADER,1 ROW,.156CTR,RT ANG,5 PIN	844717	27264	26-48-1056	1	
J 51, 52	HEADER,1 ROW,.156CTR,3 PIN	380022	00779	640388-3	2	
J 73	FIBER OPTIC,TRANSMITTER,1MBD	822155	28480	HFBR-1521	1	
J 74	FIBER OPTIC,RECEIVER,1MBD	822148	28480	HFBR-2522	1	
J 102	CONN,DIN41612,TYPE C,RT ANG,64 PIN	853437	00779	533205-2	1	
J 119,120,220	CONN,DIN41612,TYPE C,64 SCKT	807818	28213	7364-60D3TB	3	
J 121	HEADER,2 ROW,.100CTR,34 PIN	851696	59730	501-3437ES	1	
MP 1	HLDR PART,FUSE,BODY,PWB MT	602763	61935	FAU031.3573	1	
MP 2	HLDR PART,FUSE,CAP,1/4X1-1/4	460238	61935	031.1666	1	
MP 3- 10	RIVET,S-TUB,OVAL,STL,.087,.250	838482	40551	502-.087-.250	8	
MP 16	BRACKET, POWER SWITCH	885710	89536	885710	1	
MP 17, 18, 20	SPACER,SWAGED,.312 RND,BR,.177ID,.093	837864	55566	3076C177B16M0DL=.093	3	
MP 22, 23	FOOT,RUBBER,ADHES,GRY,.44 DIA,.20 THK	358341	28213	SJ-5003	2	
P 81, 82	HEADER,1 ROW,.156CTR,20 PIN	831222	55322	SEP10825-02	2	
R 1	RES,CF,91,+-5%,0.25W	441683	59124	CF1/4 910J	1	
R 2, 3	RES,WW,2,+-1%,7W	255646	05347	MSN22R00F	2	
R 4	RES,CF,68,+-5%,0.25W	414532	59124	CF1/4 680J	1	
RV 2	VARISTOR,430V,+-10%,1.0MA	519355	09214	V275LA20A	1	
SW 1	SWITCH,PUSHBUTTON,DPST,PUSH-PUSH	886697	31918	FN01NEETBN 4101BAG	1	
SW 2- 4	SWITCH,SLIDE,DPDT,LINE SELECT,RT ANG	817353	10389	18-514-0003W	3	
VR 1, 2	ϟ ZENER,UNCOMP,12V,5%,100MA,5W	876862	04713	1N5349B	2	
W 15	CABLE, FIBER OPTIC	791681	89536	791681	1	
W 90	CABLE, REAR PANEL-CPU	791665	89536	791665	1	
NOTES:	ϟ Static sensitive part.					

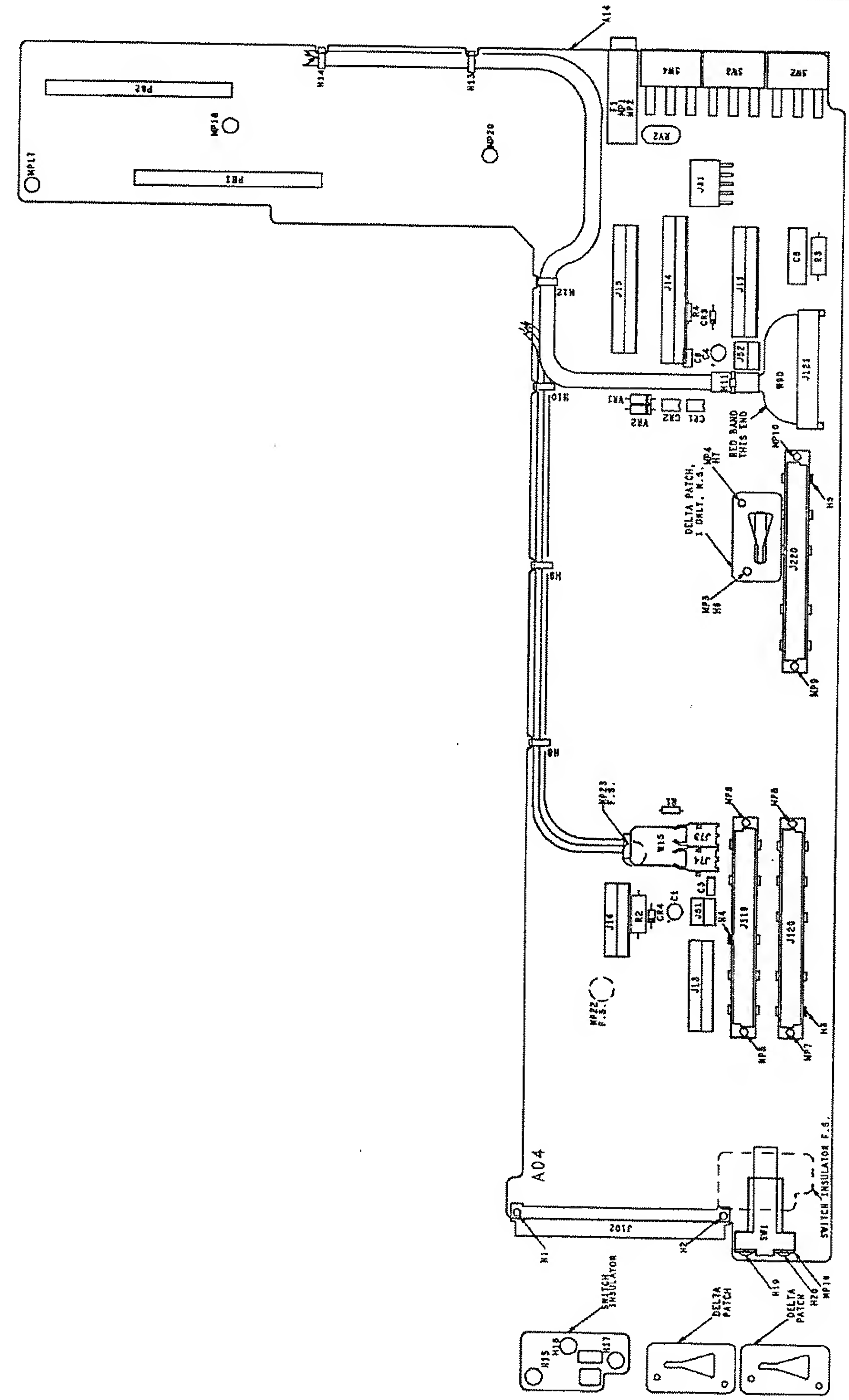

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Figure 6-6. A4 Digital Motherboard PCA

Table 6-7. A6 Wideband PCA (Option -03)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
A 1	ϟ RMS SUPPORT PCA	893268	89536	893268	1	
A 2	ϟ WB INPUT PROTECTION PCA	893271	89536	893271	1	
C 1- 3, 5, C 6- 8,110	CAP,TA,6.8UF,+-20%,10V	655043 655043	56289	199D685X0010BG2	8	
C 4,111,113	CAP,TA,22UF,+-20%,10V	658971	56289	199D226X0010CG2	3	
C 9- 19, 21, C 22, 29, 32- C 34, 36, 40	CAP,TA,4.7UF,+-20%,25V	807644 807644 807644	56289	199D475X0025BG2	19	
C 20, 24	CAP,VAR,0.35-3.5PF,250V,AIR	603456	51406	MVM-003W	2	
C 23,114	CAP,POLYES,0.1UF,+-10%,50V	649913	37942	185-2-104K50AA	2	
C 25	CAP,CER,100PF,+-2%,100V,C0G	812115	04222	SR291A101GAA	1	
C 26, 28, 31, C 35, 37, 41, C 43, 46, 48, C 53, 59, 61, C 63, 66, 67, C 73- 75, 77, C 78, 82, 83, C 87, 90- 92, C 95, 96, 98, C 99,101-103, C 105,106,	CAP,CER,0.10UF,+-20%,50V,X7R	853650 853650 853650 853650 853650 853650 853650 853650 853650 853650 853650	04222	SR595C104MAA	35	
C 27, 44, 45, C 47, 50, 57	CAP,CER,1000PF,+-20%,50V,X7R	697458 697458	04222	SR595C102MAA	6	
C 30	CAP,CER,18PF,+-2%,100V,C0G	830638	04222	SR591A180GAA	1	
C 38, 55, 79, C 93	CAP,POLYES,0.47UF,+-10%,50V	697409 697409	37942	185-2-474K50AAB	4	
C 39	CAP,POLYES,1UF,+-10%,50V	733089	68919	MKS2105K50	1	
C 49	CAP,CER,68PF,+-2%,50V,C0G	715300	04222	SR595A680GAA	1	
C 51, 54	CAP,CER,1000PF,+-2%,50V,C0G	807966	04222	SR595A102GAA	2	
C 64, 71, 76, C 86, 88, 89, C 94,100	CAP,CER,100PF,+-5%,50V,C0G	831495 831495 831495	04222	SR595A101JAA	8	
C 80, 97	CAP,CER,180PF,+-5%,50V,C0G	820522	04222	SR595A181GAA	2	
C 104	CAP,CER,22PF,+-2%,50V,C0G	714832	04222	SR595A220GAA	1	
C 107,108	CAP,TA,22UF,+-20%,25V	845149	56289	199D226X0025DG2	2	
C 115	CAP,CER,0.22UF,+80-20%,50V,Z5U	733386	04222	SR595E224ZA	1	
CR 1, 5, 14, CR 15, 24, 25, CR 30, 31	ϟ DIODE,SI,BV=200V,IO=200MA ϟ ϟ	876867 876867 876867	07263	FDH400	8	
CR 9- 12, 20, CR 21, 26- 29	ϟ DIODE,SI,BV= 75.0V,IO=150MA,500MW ϟ	698720 698720	65940	1N4448	10	
CR 16- 19, 22, CR 23	ϟ DIODE,SI,SCHOTTKY BARRIER,SMALL SIGNL ϟ	535195 535195	28480	5082-2800	6	
E 1	SURGE PROTECTOR,90V,+40 -0	198507	25088	B1-F90	1	
H 1- 4	RIVET,S-TUB,OVAL,STL,.087,.343	838458	40551	502-.087-.343	4	
J 1	CONN,COAX,SMB(M),PWB,RT ANG	353243	26805	5164-5003-09	1	
K 1, 4, 9, K 10	RELAY,ARMATURE,2 FORM C,5VDC	876854 876854	33297	EA2-5NJ	4	
K 2, 3, 5- K 8	RELAY,ARMATURE,2 FORM C,5V,LATCH	875356 875356	33297	EA2-5TNJ	6	
L 1	INDUCTOR,0.044UH,+-15%,500MHZ,SHLD	249110	72259	249110	1	
L 2	INDUCTOR,0.082UH,+-10%,500MHZ,SHLD	256289	91637	IMS-5.082UH10%	1	
L 3, 14	JUMPER,WIRE,NONINSUL,0.200CTR	816090	91984	150T1	17	
L 5- 13, 14- L 17	CHOKE,6TURN	320911 320911	89536	320911	13	
L 18	CORE,TOROID,FERRITE,0.047X0.138X0.118	321182	0LUA3	56-590-65-4B	1	
MP 5, 6	INSUL PART,TRANSISTOR MOUNT,NYL,8PIN	348581	07047	10530-N	2	
MP 7, 8	EJECTOR,PWB,NYLON	494724	32559	CP-66	2	
MP 9	OSCILLATOR THERMAL COVER	797696	89536	797696	1	
MP 10	SHIELD, WIDEBAND REAR	869081	89536	869081	1	
MP 11	SHIELD, WIDEBAND FRONT	869078	89536	869078	1	

Table 6-7. A6 Wideband PCA (Option -03) (cont)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
MP 12, 13	SCREW,PH,P,LOCK,STL,6-32,.375	152173	74594	152173	2	
P 106,206	CONN,DIN41612,TYPE C,RT ANG,64 PIN	807800	28213	7264-50D2TB	2	
Q 3, 6	TRANSISTOR,SI,N-JFET,DUAL,TO-78	876859	66182	U430	2	
Q 9	TRANSISTOR,SI,PNP,SMALL SIGNAL	402586	04713	2N2905A	1	
Q 10	TRANSISTOR,SI,NPN,SMALL SIGNAL	346916	04713	2N2219A	1	
Q 11	TRANSISTOR,SI,N-DMOS PWR FET,TO-92	782565	59640	VN0104N3	1	
Q 12- 17	TRANSISTOR,SI,N-DMOS FET,TO-72	394122	17856	SD210DE	6	
Q 19- 22	TRANSISTOR,SI,NPN,SMALL SIGNAL,TO-92	820407	27014	NSID4994	4	
Q 23	TRANSISTOR,SI,PNP,15V,0.15W,TO-72	876870	0LUA3	BFQ52	1	
R 1, 2, 8, R 34, 51, 55, R 80,123	RES,MF,1K,+-1%,0.125W,100PPM	719468 719468 719468	91637	CMF-55 1001F T-1	8	
R 3, 4, 6, R 95,131	RES,MF,10K,+-1%,0.125W,100PPM	719476 719476	91637	CMF-55 1002F T-1	5	
R 5,140	RES,CF,5.1K,+-5%,0.25W	573329	59124	CF1/4 512J	2	
R 7	RES,MF,24.9,+-1%,0.125W,100PPM	296657	91637	CMF-55 24R9F T-1	1	
R 9,144,145	RES,MF,15,+-1%,0.125W,100PPM	296434	91637	CMF-55 15R0F T-1	3	
R 18, 62	RES,MF,499K,+-1%,0.125W,100PPM	268813	91637	CMF-55 4993FT-1	2	
R 19,132,133	RES,CF,100,+-5%,0.25W	573014	59124	CF1/4 101J	3	
R 21	RES,MF,442K,+-1%,0.125W,100PPM	375956	91637	CMF-55 4423F T-1	1	
R 25, 29, 35	RES,MF,49.9,+-1%,0.125W,100PPM	720318	91637	CMF-55 49R9F T-1	3	
R 28,117,119, R 139	RES,CF,2M,+-5%,0.25W	643676 643676	59124	CF1/4 205J	4	
R 37	RES,CC,51,+-5%,1W	157586	01121	GB5105	1	
R 43	RES,MF,50,+-0.05%,0.125W,15PPM	500264	91637	PTF-56 50R F T-10	1	
R 44	RES,MF,154,+-1%,0.125W,100PPM	866202	91637	CMF-55 1540F T-1	1	
R 45, 87	RES,MF,1.27K,+-1%,0.5W,100PPM	245753	91637	CMF-65 1271F T-1	2	
R 46, 54, 60, R 67,115,120	RES,CF,5.1,+-5%,0.25W	640995 640995	59124	CF1/4 5R1J	6	
R 38, 48, 65, R 73, 83, 96, R 99,105,143	RES,CF,51,+-5%,0.25W	572990 572990 572990	59124	CF1/4 510J	9	
R 49,106,126, R 141	RES,MF,499,+-1%,0.125W,50PPM	289256 289256	91637	CMF-55 4990F T-2	4	
R 53, 94	RES,MF,30.9,+-1%,0.125W,100PPM	321315	91637	CMF-55 30R9F T-1	2	
R 57, 63	RES,CF,1.5K,+-5%,0.25W	573212	59124	CF1/4 152J	2	
R 58,110	RES,CF,3K,+-5%,0.25W	573279	59124	CF1/4 302J	2	
R 68	RES,MF,54.9K,+-1%,0.125W,100PPM	271353	91637	CMF-55 5492F T-1	1	
R 69, 70, 92, R 114,116	RES,MF,909,+-1%,0.125W,100PPM	720565 720565	91637	CMF-55 9090F T-1	5	
R 71, 77, 84, R 97,121,125	RES,MF,82,+-5%,2W,100PPM	876875 876875	91637	CPF-2820J T-1	6	
R 72,111	RES,MF,3.32K,+-1%,0.125W,100PPM	866269	91637	CMF-55 3321F T-1	2	
R 74,109	RES,MF,392,+-1%,0.125W,100PPM	260299	91637	CMF-55 3920F T-1	2	
R 75	RES,CF,330K,+-5%,0.25W	641159	59124	CF1/4 334J	1	
R 76	RES,MF,1.5K,+-1%,0.125W,100PPM	719682	91637	CMF-55 1501F T-1	1	
R 78	RES,CF,3.6K,+-5%,0.25W	573295	59124	CF1/4 362J	1	
R 79, 93	RES,MF,237,+-1%,0.125W,100PPM	853528	91637	CMF55 2370 F T-1	2	
R 81	RES,MF,332,+-1%,0.125W,100PPM	192898	91637	CMF-55 3320F T-1	1	
R 82	RES,CF,82K,+-5%,0.25W	573568	59124	CF1/4 823J	1	
R 85, 88	RES,CF,68K,+-5%,0.25W	573550	59124	CF1/4 683J	2	
R 86	RES,MF,26.7K,+-1%,0.125W,100PPM	245779	91637	CMF-55 2672F T-1	1	
R 89, 91	RES,MF,6.49K,+-1%,0.125W,100PPM	720466	91637	CMF-55 6491F T-1	2	
R 90	RES,MF,301,+-1%,0.125W,100PPM	720029	91637	CMF-55 3010F T-1	1	
R 100,104,122, R 124	RES,MF,243,+-0.1%,0.125W,50PPM	512228 512228	91637	CMF-55 2430B T-2	4	
R 103	RES,MF,110K,+-1%,0.125W,100PPM	234708	91637	CMF-55 1103F T-1	3	

Table 6-7. A6 Wideband PCA (Option -03) (cont)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
R 118	RES,MF,20,+-1%,0.125W,100PPM	236844	91637	CMF-55 20R0F T-1	1	
R 129	RES,CF,2.4K,+-5%,0.25W	573253	59124	CF1/4 242J	1	
R 134,135	RES,MF,34.8,+-1%,0.125W,100PPM	343897	91637	CMF-55 8060F T-1	2	
R 136	RES,MF,84.5,+-1%,0.125W,100PPM	236851	91637	CMF-55 84R5F T-1	1	
R 137,147	RES,MF,357,+-1%,0.125W,100PPM	443036	91637	CMF-55 3570F T-1	2	
R 142	RES,MF,536,+-1%,0.125W,100PPM	500892	91637	CMF-55 5360F T-1	1	
R 146	RES,MF,66.5,+-1%,0.125W,100PPM	305987	91637	CMF-55 66R5F T-1	1	
R 148,149	RES,CF,1,+-5%,0.25W	572883	81349	RCR07G1R0JS	2	
U 1, 10, 12	ϟ IC,OP AMP,DUAL,LO OFFST VOLT,LO-DRIFT	851704	27014	LF412ACN	3	
U 2, 3, 5	ϟ IC,OP AMP,CUR FEEDBACK,WIDE BW,CERDIP	886684	24355	AD9618AQ	3	
U 4	ϟ IC,VOLT REG,FIXED,+5 VOLTS,1.5 AMPS	355107	04713	MC7805CT	1	
U 6, 8	ϟ IC,VOLT REG,ADJ,1.2 TO 37 V,1.5 AMPS	460410	27014	LM317T	2	
U 7, 9	ϟ IC,VOLT REG,ADJ,NEG,-1.2VTO-37V,1.5A	772996	04713	LM337T	2	
U 11	ϟ IC,COMPARATOR,HI-SPEED,14 PIN DIP	556449	18324	NE521N	1	
U 13	ϟ IC,COMPARATOR,DUAL,LO-PWR,8 PIN DIP	478354	27014	LM393N	1	
U 14	ϟ IC,VOLT REG,FIXED,-5 VOLTS,1.5 AMPS	394551	04713	MC7905CT	1	
U 15	RMS CONVERTER TESTED 400 OHM-A GRADE	842591	89536	842591	1	
U 16	ϟ IC,CMOS,QUAD SPST ANALOG SWITCH	875328	17856	DG271CJ	1	
U 20, 21	ϟ IC,CMOS,OCTL D F/F W/3-STATE,+EDG TRG	585364	04713	MC74HCT374N	2	
U 23, 24	ϟ IC,COMPARATOR,QUAD,14 PIN DIP	387233	04713	LM339N	2	
U 25, 26	ϟ IC,BIMOS,8 CHNL HI-VOLT DRVR W/LATCH	782912	56289	UCN5801A	2	
U 27	ϟ IC,CMOS,QUAD 2 INPUT NAND GATE	707323	04713	MC74HC00AN	1	
VR 3, 4	ϟ ZENER,UNCOMP,3.9V,5%,64.0MA,1.0W	836700	04713	1N4730A	2	
VR 7	ϟ ZENER,UNCOMP,30.0V,5%,4.2MA,0.5W	634121	04713	IN5256B	1	
Z 1, 3	ϟ RN/SUPPORT ASSY-4R03H	885512	89536	885512	2	
Z 2	ϟ RN/SUPPORT ASSY-4R04H	885517	89536	885517	1	
Z 4	ϟ RN/SUPPORT ASSY-4R05H	885520	89536	885520	1	
Z 5, 9, 10	RES,CERM,SIP,8 PIN,4 RES,10K,+-2%	513309	91637	CSC08A-03-103G	3	
Z 6	RES,CERM,SIP,8 PIN,7 RES,10K,+-2%	412924	91637	CSC08A-01-103G	1	
Z 7	RES,CERM,SIP,8 PIN,4 RES,1K,+-2%	714345	91637	CSC08A-03-102G	1	
NOTES:	ϟ Static sensitive part.					

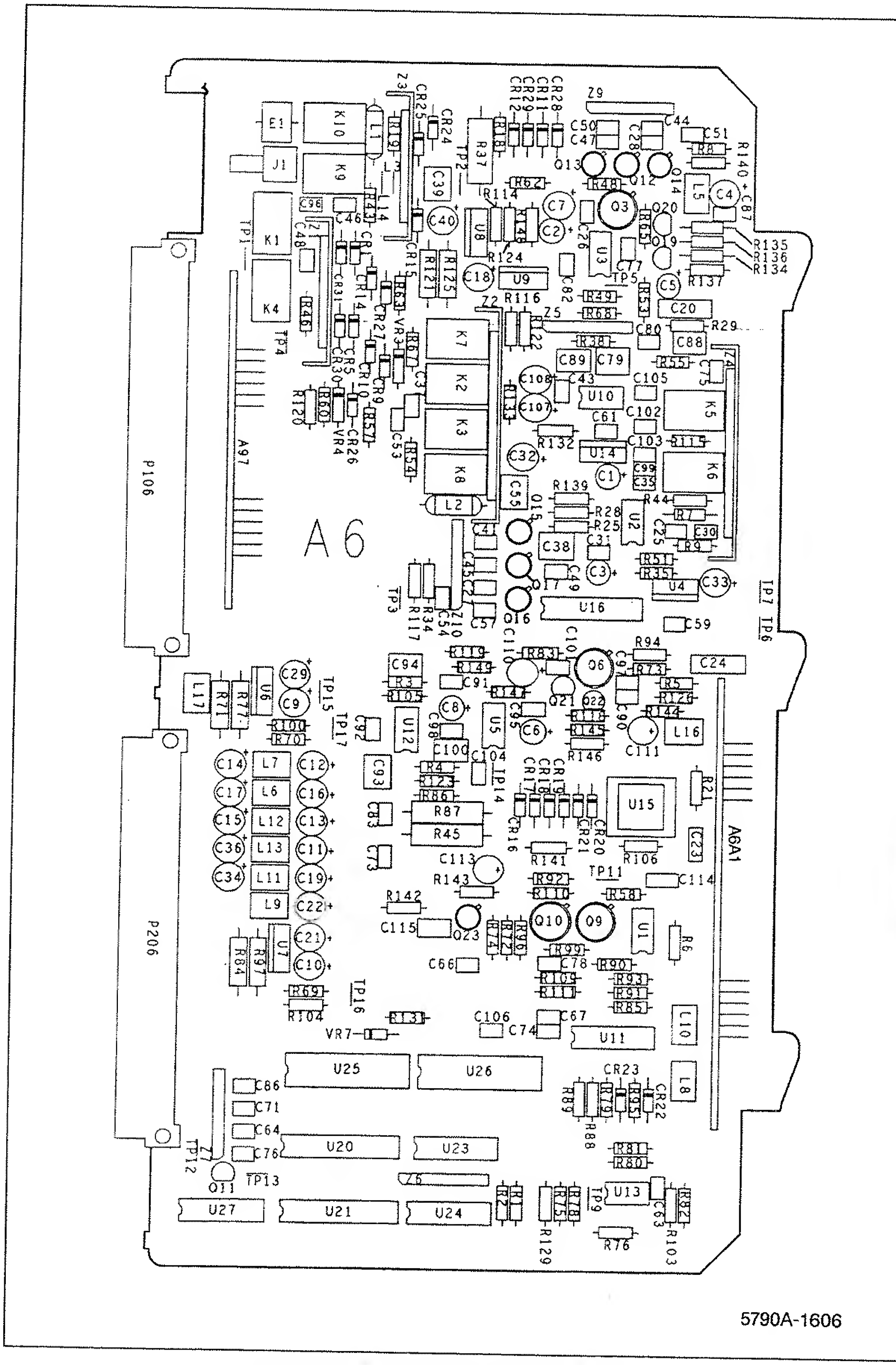

Figure 6-7. A6 Wideband PCA (Option -03)

Table 6-8. A6A1 RMS Support PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1	CAP,TA,4.7UF,+-20%,25V	807644	56289	199D475X0025BG2	1	
C 2, 7, 8, C 10, 12, 13, C 16	CAP,POLYES,0.01UF,+-10%,50V	715037 715037 715037	37942	185-2-103K50A/A	7	
C 3, 4	CAP,POLYES,0.47UF,+-10%,50V	697409	37942	185-2-474K50AAB	2	
C 5	CAP,POLYES,1UF,+-10%,50V	733089	37942	185-2-105K50AA	1	
C 6	CAP,POLYES,0.047UF,+-10%,50V	820548	37942	185-2-473K50AA	1	
C 9, 11	CAP,POLYES,0.1UF,+-10%,50V	649913	37942	185-2-104K50AA	2	
C 14	CAP,CER,330PF,+-5%,50V,C0G	697441	04222	SR595A331JAA	1	
C 15, 17	CAP,CER,82PF,+-2%,50V,C0G	714857	04222	SR595A820GAA	2	
CR 1	ϟ DIODE,SI,PIN,RF SWITCHING	875591	8A233	BA483-143	1	
CR 2	ϟ DIODE,SI,BV= 75.0V,IO=150MA,500MW	698720	65940	1N4448	1	
JM 1	JUMPER,WIRE,NONINSUL,0.200CTR	816090	91984	150T1	3	
P 1, 2	HEADER,2 ROW,.100CTR,RT ANG,12 PIN	806935	22526	68715-412	2	
Q 1, 2	ϟ TRANSISTOR,SI,NPN,SMALL SIGNAL,TO-92	820407	27014	NSID4994	2	
Q 3	ϟ TRANSISTOR,SI,N-JFET,TO-92	832162	17856	J2908	1	
R 1	RES,CF,1K,+-5%,.25W	343426	89536	343426	1	
R 2	RES,CF,36,+-5%,.25W	442236	89536	442236	1	
R 3	RES,CF,1.5K,+-5%,.25W	343418	89536	343418	1	
R 4	RES,MF,10K,+-1%,0.125W,100PPM	168260	89536	168260	1	
R 5	RES,MF,1K,+-1%,0.125W,100PPM	168229	89536	168229	1	
R 6, 10	RES,CF,750,+-5%,0.25W	441659	89536	441659	2	
R 7	RES,CF,62K,+-5%,0.25W	348904	89536	348904	1	
R 8	RES,MF,2K,+-1%,0.125W,100PPM	235226	89536	235226	1	
R 9	RES,CF,2M,+-5%,0.25W	442582	89536	442582	1	
R 11	RES,CF,330,+-5%,0.25W	368720	89536	368720	1	
R 12	RES,CF,2.4K,+-5%,0.25W	441493	89536	441493	1	
R 13	RES,CF,200K,+-5%,0.25W	441485	89536	441485	1	
R 14	RES,MF,1.43K,+-1%,0.125W,25PPM	447995	91637	CMF-55 1431F T-9	1	
R 15	RES,CF,1.5K,+-5%,0.25W	343418	89536	343418	1	
U 1	ϟ IC,COMPARATOR,HI-SPEED,PRECISION	822197	64155	LT1016CN8	1	
U 2	ϟ IC,FTTL,SYNC DIV BY 16 BINARY CNTR	876883	04713	MC74F161AN	1	
U 3	ϟ IC,CMOS,QUAD SPST ANALOG SWITCH	875328	17856	DG271CJ	1	
U 4	ϟ IC,ARRAY,5 TRANS,5 ISO: 2-PNP,3-NPN	418954	34371	CA3096E	1	
U 5	ϟ IC,OP AMP,DUAL,PRECISION,8-PIN DIP	783696	64155	LT1013CN8	1	
U 6	ϟ IC,BPLR,ANALOG MULTIPLIER	845151	24355	AD42020-1	1	
VR 1	ϟ ZENER,COMP,6.4V,5%,1PPM,2MA	381988	04713	SZG20120	1	
Z 1- 3	RES,CERM,SIP,8 PIN,4 RES,1K,+-2%	714345	91637	CSC08A-03-102G	3	
Z 4, 5	RES,CERM,SIP,8 PIN,4 RES,10K,+-2%	513309	91637	CSC08A-03-103G	2	
NOTES:	ϟ Static sensitive part.					

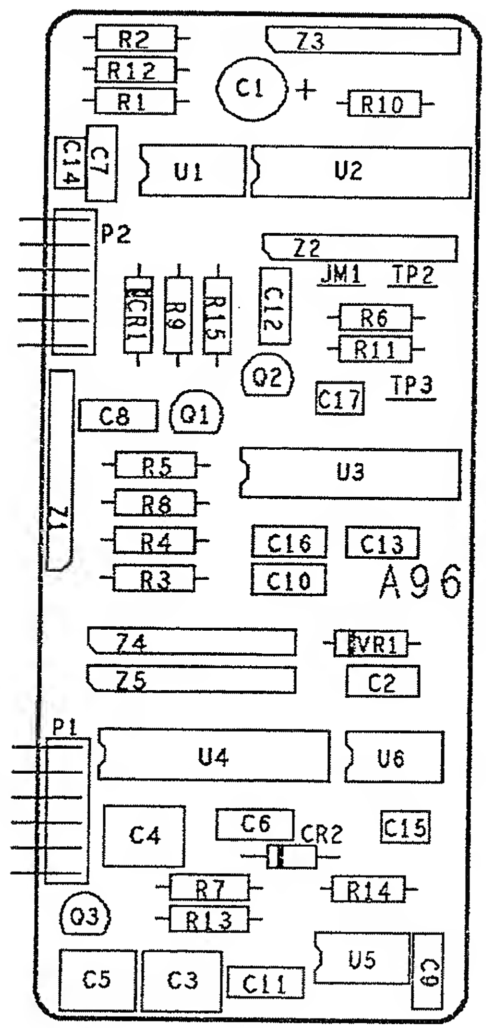

Figure 6-8. A6A1 RMS Support PCA

Table 6-9. A6A2 WB Input Protection PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 24, 25	CAP,POLYES,0.01UF,+-10%,50V	715037	37942	185-2-103K50A/A	2	
C 84, 85	CAP,TA,4.7UF,+-20%,25V	807644	56289	199D475X0025BG2	2	
CR 2- 4, 6- CR 8	ϟ DIODE,SI,BV= 75.0V,IO=150MA,500MW ϟ	698720 698720	65940	1N4448	6	
MP 1, 2	INSUL PART,TRANSISTOR MOUNT,DAP,TO-5	152207	07047	10123-DAP	2	
P 1, 2	HEADER,2 ROW,.100CTR,RT ANG,12 PIN	806935	22526	68715-412	2	
Q 1	ϟ TRANSISTOR,SI,PNP,SMALL SIGNAL	402586	04713	2N2905A	1	
Q 2	ϟ TRANSISTOR,SI,NPN,SMALL SIGNAL	346916	04713	2N2219A	1	
R 1- 3, 5, R 9, 12, 15	RES,MF,10K,+-1%,0.125W,100PPM	719476 719476	91637	CMF-55 1002F T-1	7	
R 4, 7	RES,CC,130,+-5%,1W	163055	01121	GB1315	2	
R 6, 10	RES,CF,130,+-5%,0.25W	573022	59124	CF1/4 131J	2	
R 8, 13	RES,CF,16K,+-5%,0.25W	641118	59124	CF1/4 163J	2	
R 11, 14	RES,CF,470,+-5%,0.25W	573121	59124	CF1/4 471J	2	
R 17	RES,CF,2.4K,+-5%,0.25W	573253	59124	CF1/4 242J	1	
R 20	RES,CF,100K,+-5%,0.25W	573584	59124	CF1/4 104J	1	
R 24	RES,CF,1.8M,+-5%,0.25W	442574	59124	CF1/4 1804J	1	
U 1	ϟ IC,COMPARATOR,DUAL,HI-SPEED,14 DIP	647123	27014	LM319N	1	
VR 1, 2	ϟ ZENER,UNCOMP,12V,5%,100MA,5W	876862	04713	1N5349B	2	
NOTES:	ϟ Static sensitive part.					

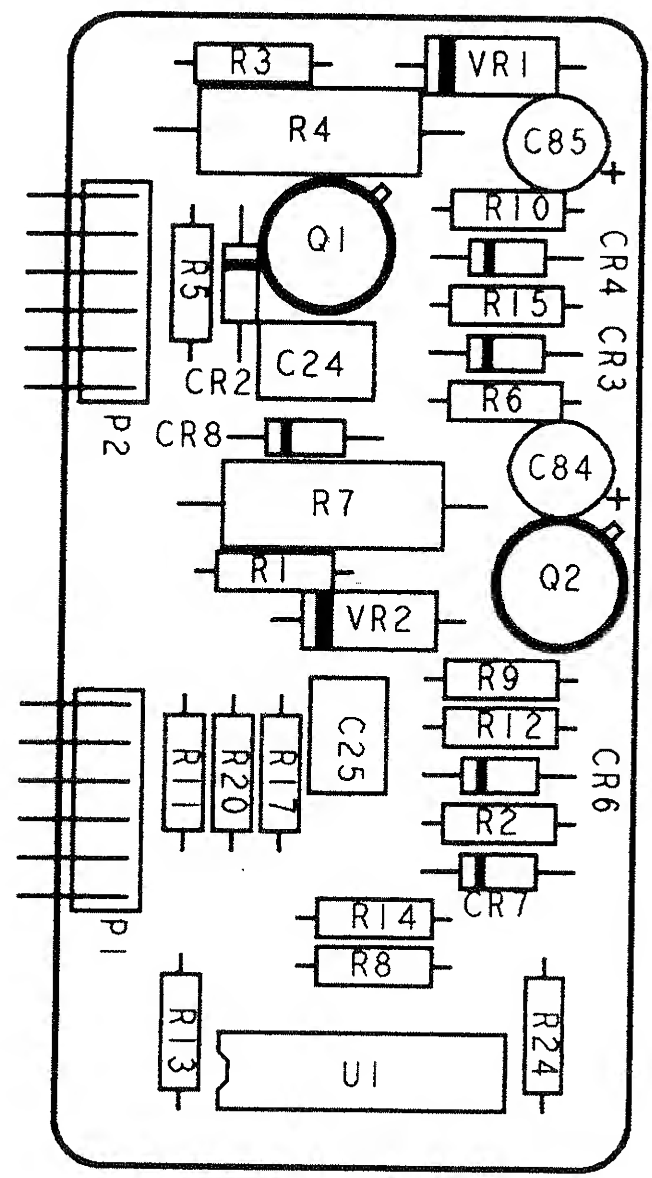

Figure 6-9. A6A2 WB Input Protection PCA

Table 6-10. A10 Transfer PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
A 1	ϟ PRECISION AMPLIFIER PCA	893300	89536	893300	1	
A 2	ϟ HIGH VOLTAGE PROTECTION PCA	893305	89536	893305	1	
A 3	ϟ HIGH GAIN PRECISION AMP PCA	893313	89536	893313	1	
C 1	CAP,POLYES,0.047UF,+-10%,50V	820548	37942	185-2-473K50AA	1	
C 2	CAP,POLYES,1UF,+-10%,50V	733089	37942	185-2-105K50AA	1	
C 3,	CAP,CER,100PF,+-20%,50V,C0G	721605	04222	SR595A101MAA	1	
C 4, 9, 21, C 24- 28,101- C 108,112-117, C 130-132,140- C 143,150,151	CAP,POLYES,0.1UF,+-10%,50V	649913 649913 649913 649913 649913	37942	185-2-104K50AA	31	
C 5	CAP,CER,120PF,+-2%,100V,C0G	543819	04222	SR151A121JAA	1	
C 6	CAP,CER,4.7PF,+-0.25PF,50V,C0G	721837	04222	SR215A4R7CAA	1	
C 7, 13, 14, C 16, 18	CAP,CER,470PF,+-5%,50V,C0G	830430 830430	04222	SR595A471JAA	5	
C 8	CAP,CER,10PF,+-2%,50V,C0G	713875	04222	SR595A100GAA	1	
C 10, 11,120- C 124	CAP,TA,10UF,+-20%,35V	816512 816512	56289	199D106X0035DG2	7	
C 12	CAP,POLYES,0.22UF,+-5%,50V	747519	37942	185-2-224J50AA	1	
C 15, 17	CAP,POLYES,0.47UF,+-10%,50V	697409	37942	185-2-474K50AAB	2	
C 19	CAP,CER,1.8PF,+-0.25PF,100V,C0K	816660	04222	SR591A1R8CAA	1	
C 20	CAP,CER,82PF,+-2%,50V,C0G	714857	04222	SR595A820GAA	1	
C 22, 23	CAP,CER,1000PF,+-20%,50V,X7R	697458	04222	SR595C102MAA	2	
C 29	CAP,CER,2.7PF,+-0.25PF,100V,C0J	816231	04222	SR071A2R7CAA	1	
C 30	CAP,CER,33PF,+-5%,50V,C0G	714543	04222	SR595A330JAA	1	
C 31	CAP,CER,270PF,+-5%,50V,C0G	658898	04222	SR595A271JAA	1	
C 110,111	CAP,TA,4.7UF,+-20%,25V	807644	56289	199D475X0025BG2	2	
CR 1- 4	ϟ DIODE,SI,BV=35V, LOW LEAKAGE	723817	17856	J2723TR	4	
CR 5- 24, 26, CR 27, 30- 33	ϟ DIODE,SI,BV= 75.0V,RADIAL INSERTED ϟ	659516 659516	15238	1N4448	26	
CR 28, 29	ϟ DIODE,SI,BV=125.0V,IO=150MA,500 MW	844647	07263	XDH9912	2	
E 1, 2	SURGE PROTECTOR,450V,+-10%	442723	25088	B2-B470-Y23	2	
H 1- 4	RIVET,S-TUB,OVAL,STL,.087,.343	838458	40551	502-.087-.343	4	
H 6, 9, 10	SCREW,PH,P,LOCK,STL,8-32,.375	114124	74594	114124	3	
H 7, 8, 11, H 12	SCREW,PH,P,LOCK,STL,6-32,.250	152140 152140	74594	152140	4	
H 13, 14	SCREW,PH,P,LOCK,STL,6-32,.375	152165	74594	152165	2	
H 15, 16	SCREW,PH,P,LOCK,SS,6-32,.750	376822	74594	376822	2	
H 17, 18	SPACER,SWAGE,.250 RND,BR,.150,.400	743229	55566	1531B-.150B-14-MOD=400	4	
K 1- 4	RELAY,ARMATURE,2 FORM C,4.5 V,SEALED	875638	26806	AZ2429-217-201	4	
K 5, 8	RELAY,ARMATURE,2 FORM C,5V	733063	61529	DS2E-S-DC5V	2	
K 6	RELAY,ARMATURE,2 FORM C,5 VDC,LATCH	910773	61529	TQ2E-L2-5V	1	
K 7	RELAY,ARMATURE,2 FORM C,5V,LATCH	875356	33297	EA2-5TNJ	1	
L 1	INDUCTOR,12UH,+-5%,47MHZ,SHLD	820720	24759	MR-12.0J&K	1	
L 2	INDUCTOR,8.2UH,+-5%,58MHZ,SHLD	806521	24759	MR-8.20J	1	
MP 1	OSCILLATOR THERMAL COVER	797696	89536	797696	1	
MP 2, 3	EJECTOR,PWB,NYLON	494724	32559	CP-66	2	
MP 5	R-NET HOUSING, TOP, 1R02	874888	89536	874888	1	
MP 7	R-NET HOUSING, BOTTOM, 1R02	874891	89536	874891	1	
MP 8	SHIELD, HIGH VOLTAGE, REAR	791921	89536	791921	1	
MP 9, 10	GASKET	885715	89536	885715	2	
MP 11, 12	ϟ PWB, THERMAL SHIELD	893359	89536	893359	2	
MP 13, 14	FOAM, THERMAL COVER	893362	89536	893362	2	
P 110,210	CONN,DIN41612,TYPE C,RT ANG,64 PIN	807800	28213	7264-50D2TB	2	
Q 1	ϟ TRANSISTOR,SI,NMOS,1W,4 PIN DIP	853692	17856	V12948	1	
Q 2, 3	ϟ TRANSISTOR,SI,N-JFET,UHF/VHF USE	403634	17856	J2765	2	

Table 6-10. A10 Transfer PCA (cont)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
Q 4, 7	ϟ TRANSISTOR,SI,N-DMOS FET,TO-72	394122	17856	SD210DE	2	
Q 5, 6, 9,	ϟ TRANSISTOR,SI,N-DMOS PWR FET,TO-92	782565	59640	VN0104N3	4	
Q 12	ϟ TRANSISTOR,SI,N-DMOS PWR FET,TO-92	782565				
Q 8	ϟ TRANSISTOR,SI,P-MOS,ENHANCEMENT,TO-72	741058	17856	3N163	1	
Q 10	ϟ TRANSISTOR,SI,PNP,DUAL,TO-78	875752	24355	MAT-03AH	1	
Q 11	ϟ TRANSISTOR,SI,NPN,DUAL,DIP	887844	27014	LM394N	1	
Q 101	ϟ TRANSISTOR,SI,N-JFET,TO-92	477448	17856	J2450	1	
R 1- 4	RES,CF,390K,+-5%,0.25W	706754	59124	CF1/4 394J	4	
R 5, 6	RES,CF,6.2M,+-5%,0.25W	772327	59124	CF1/4-6204J	2	
R 7	RES,MF,90.9,+-1%,2W,10PPM	886791	64537	A3AF53	1	
R 8,	RES,MF,499,+-1%,0.125W,100PPM	866686	59124	MF50D4990F	1	
R 9, 18, 19, R 22, 24- 26, R 51, 70, 71, R 80, 81	RES,CF,1K,+-5%,0.25W	780585 780585 780585 780585	59124	CF1/4 102J	12	
R 10, 31, 42	RES,MF,150,+-1%,0.125W,100PPM	822171	59124	MF50D1500F	3	
R 11, 20	RES,MF,1K,+-1%,0.125W,100PPM	816595	81349	RNR55C1001FS	2	
R 12, 29, 34	RES,CF,100K,+-5%,0.25W	658963	59124	CF1/4 104J	3	
R 14, 15	RES,MF,75K,+-1%,0.125W,100PPM	851902	59124	MF50D7502F	2	
R 16, 28	RES,CF,62K,+-5%,0.25W	713941	59124	CF1/4 623J	2	
R 17	RES,CF,430,+-5%,0.25W	817577	59124	CF1/4 431J	1	
R 21	RES,CF,100,+-1%,0.125W,100PPM	817627	81349	RNR55C1000FS	1	
R 23	RES,MF,412K,+-1%,0.125W,50PPM	714287	59124	MF50C4123F	1	
R 27	RES,VAR,CERM,10K,+-10%,0.5W	285171	80294	3386-1-103	1	
R 30, 41	RES,MF,1.37K,+-1%,.125W,50PPM	875369	59124	MF50C1371F	2	
R 32	RES,MF,432,+-1%,.125W,50PPM	875364	59124	MF50C4320F	1	
R 33, 44	RES,MF,200,+-1%,0.125W,100PPM	820282	59124	MF50D2000F	2	
R 35, 54- 56	RES,CF,4.7K,+-5%,0.25W	721571	59124	CF1/4 472J	4	
R 36	RES,MF,69.8,+-1%,0.125W,100PPM	306001	91637	CMF-55 69R8F T-1	1	
R 37	RES,MF,909,+-1%,0.125W,100PPM	820308	81349	RNR55C9090FS	1	
R 38, 61, 62	RES,CF,200,+-5%,0.25W	810390	59124	CF1/4 201J	3	
R 43	RES,MF,1.82K,+-1%,.125W,100PPM	851527	91637	CMF-55 1821F T-1	1	
R 50	RES,CF,470,+-5%,0.25W	854567	59124	CF1/4 471J	1	
R 52	RES,MF,15K,+-1%,0.125W,100PPM	866702	59124	MF50D1502F	1	
R 53	RES,MF,3.83K,+-1%,0.125W,100PPM	821827	59124	MF50D3831F	1	
R 60, 63	RES,CF,18K,+-5%,0.25W	681858	59124	CF1/4 183J	2	
R 101	RES,CF,200K,+-5%,0.25W	681841	59124	CF1/4 204J	1	
R 103	RES,MF,1.43K,+-1%,0.125W,25PPM	447995	91637	CMF-55 1431F T-9	1	
R 105	RES,CF,10K,+-5%,0.25W	697102	59124	CF1/4 103J	1	
TP 1, 2, 4- TP 9	JUMPER,WIRE,NONINSUL,0.200CTR	816090 816090	91984	150T1	8	
U 1	ϟ IC,DMOS,QUAD ANALOG SWITCH,SOIC	928291	89536	928291	1	
U 2, 3	ϟ IC,CMOS,QUAD BILATERAL SWITCH	910708	17856	DG444DJ	2	
U 4	ϟ IC,OP AMP,JFET INPUT,8 PIN DIP	472779	27014	LF356N	1	
U 5	RMS CONVERTER TESTED 400 OHM-A GRADE	842591	89536	842591	1	
U 6	ϟ IC,OP AMP,HIGH SPEED,LOW NOISE,8 DIP	876081	13919	OPA637AP	1	
U 11	ϟ IC,OP AMP,HI SPEED	875414	24355	AD846BN	1	
U 12	ϟ IC,DMOS,FET QUAD SWITCH	876420	17856	SD5000N	1	
U 15	ϟ IC,VOLT REG,FIXED,+12 VOLTS,0.1 AMPS	408138	01295	UA78L12ACLP	1	
U 16	ϟ IC,VOLT REG,FIXED,-12 VOLTS,0.1 AMPS	473819	04713	MC79L12ACP	1	
U 20, 21	ϟ IC,BIMOS,8 CHNL HI-VOLT DRVR W/LATCH	782912	56289	UCN5801A	2	
U 22, 23	ϟ IC,CMOS,OCTAL D F/F,+EDG TRG	811166	04713	MC74HC374N	2	
U 24	ϟ IC,LSTTL,OCTAL D F/F,+EDG TRG	473223	01295	SN74LS374N	1	
U 30	ϟ IC,OP AMP,QUAD JFET INPUT,14 PIN DIP	659748	01295	TL074CN	1	

Table 6-10. A10 Transfer PCA (cont)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
U 31, 34	ϟ IC,COMPARATOR,QUAD,14 PIN DIP	387233	04713	LM339N	2	
U 32, 33	ϟ ISOLATOR,OPTO,LED TO TRANSISTOR,DUAL	454330	25088	ILCT-6-254	2	
U 36	ϟ IC,CMOS,QUAD 2 INPUT NAND GATE	707323	04713	MC74HC00AN	1	
U 102	ϟ IC,OP AMP,DUAL,PRECISION,8-PIN DIP	783696	64155	LT1013CN8	1	
U 103	ϟ IC,BPLR,ANALOG MULTIPLIER	845151	24355	AD42020-1	1	
VR 1, 2	ϟ ZENER,UNCOMP,9.1V,5%,5MA,0.350W	853788	04713	1N5239B	2	
VR 101	ϟ ZENER,COMP,6.4V,5%,1PPM,2MA	381988	04713	SZG20120	1	
Z 1	ϟ SUBSTRATE ASSY, 4R02	885736	89536	885736	1	
Z 2	RES,CERM,SIP,6 PIN,5 RES,330,+-2%	408302	91637	CSC06A-01-331G	1	
Z 3	RES,CERM,SIP,6 PIN,5 RES,10K,+-2%	500876	91637	CSC06A-01-103G	1	
Z 4	RES,CERM,SIP,6 PIN,5 RES,100K,+-2%	412726	91637	CSC06A-03-104G	1	
Z 6	RES,CERM,SIP,8 PIN,7 RES,10K,+-2%	412924	91637	CSC08A-01-103G	1	
Z 101,102	RES,CERM,SIP,8 PIN,4 RES,10K,+-2%	513309	91637	CSC08A-03-103G	2	
NOTES:	ϟ Static sensitive part.					

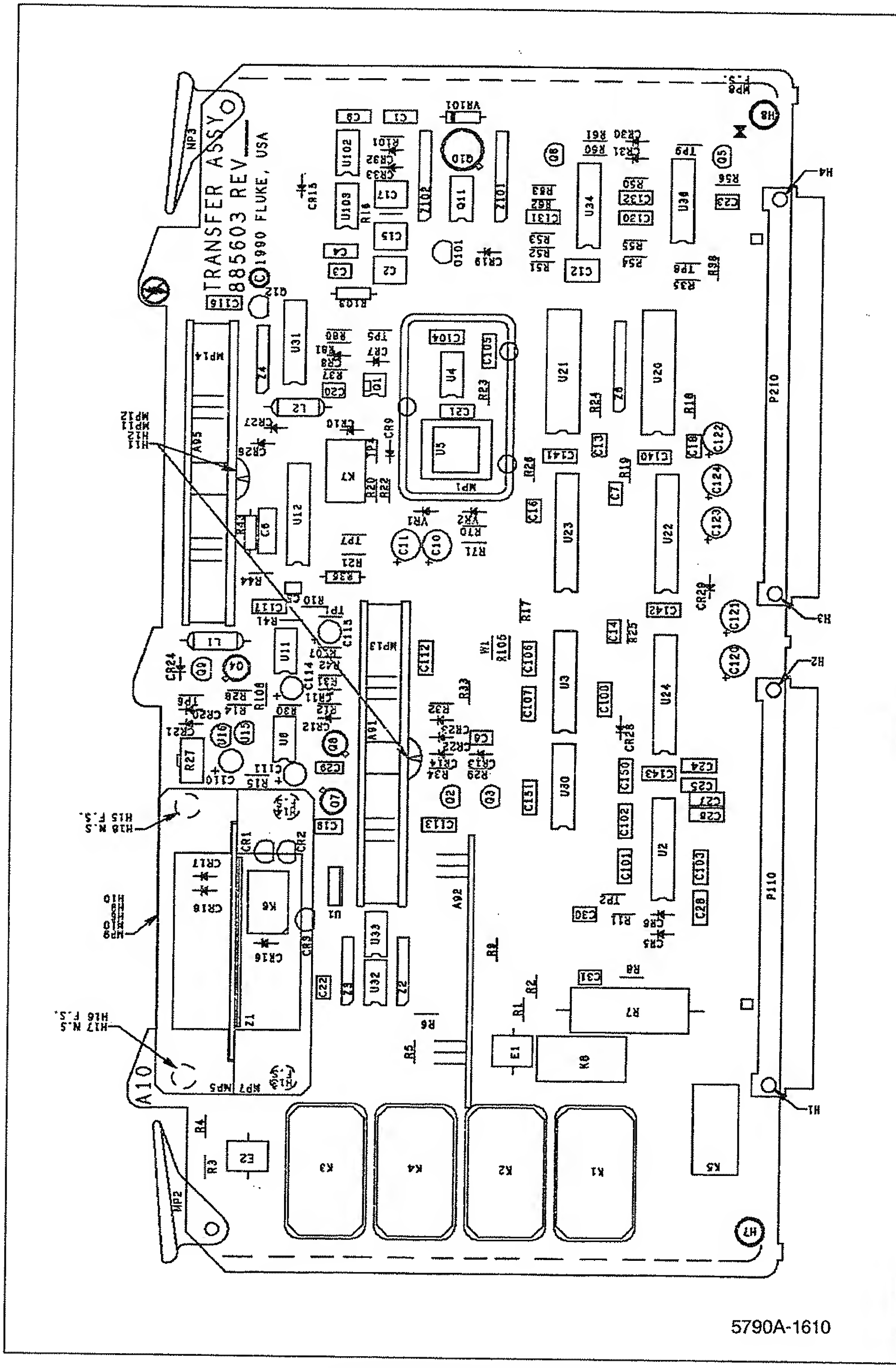

Figure 6-10. A10 Transfer PCA

Table 6-11. A10A1 Precision Amplifier PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1, 2	CAP,CER,270PF,+-10%,50V,C0G,1206	837385	04222	12065A271KAT050B	2	
C 3	CAP,TA,4.7UF,+-20%,10V,3528	867262	56289	293D475X0010B2T OR W	1	
C 4	CAP,POLYES,0.47UF,+-5%,50V,2225	887083	02768	474J050ST2225T	1	
C 7- 11	CAP,CER,0.22UF,+80-20%,50V,Y5V,1206	740597	51406	GRM42-6Y5V221Z050PB	5	
CR 1, 2, 5	ϟ DIODE,SI,BV=70.0V,IO=50MA,DUAL,SOT23	742320	8A233	BAV99	3	
CR 3, 6	ϟ DIODE,SI,N-JFET,CURRENT REG,IF=2.0 MA	284927	17856	J9014	2	
CR 4	ϟ DIODE,SI,N-JFET,CURRENT REG,IF=5.3 MA	334714	17856	J9010	1	
H 1	SPACER,SWAGE,.250 RND,BR,6-32,.325	296137	55566	3045B632B14-MOD.=.325	1	
P 1, 2	HEADER,2 ROW,.100CTR,RT ANG,6 PIN	912217	0AKZ5	LPEG06DR-TIR125135	2	
Q 1	ϟ TRANSISTOR,SI,N-JFET,DUAL,SOIC	876425	17856	SST441-TR1	1	
Q 2, 3, 8, Q 9	ϟ TRANSISTOR,SI,PNP,SMALL SIGNAL,SOT-23 ϟ	742684 742684	04713	MMBT3906T	4	
Q 4- 6	ϟ TRANSISTOR,SI,NPN,SMALL SIGNAL,SOT-23	742676	04713	MMBT3904T	3	
Q 7, 10	ϟ TRANSISTOR,SI,N-JFET,SOT23	844584	17856	SSTH20	2	
R 1	ϟ RES,CERM,180,+-5%,.125W,200PPM,1206	746321	91637	CRCW1206-1800JB02	1	
R 2	ϟ RES,CERM,6.2K,+-5%,.125W,200PPM,1206	746016	91637	CRCW1206-6201JB	1	
R 3	ϟ RES,CERM,12,+-5%,.125W,200PPM,1206	845458	91637	CRCW1206-12R0JB02	1	
R 4, 8	ϟ RES,CERM,10K,+-5%,.125W,200PPM,1206	746610	91637	CRCW1206-1002JB	2	
R 5	ϟ RES,CERM,18K,+-5%,.125W,200PPM,1206	746636	91637	CRCW1206-1802JB	1	
R 6, 7	ϟ RES,CERM,124,+-1%,.125W,100PPM,1206	867499	91637	CRCW1206-1240FB	2	
R 10, 11	ϟ RES,CERM,432,+-1%,.125W,100PPM,1206	811885	91637	CRCW1206-4320FB	2	
R 12	ϟ RES,CERM,1K,+-5%,.125W,200PPM,1206	745992	91637	CRCW1206-1001JB	1	
R 14	ϟ RES,CERM,1.5K,+-5%,.125W,200PPM,1206	746438	91637	CRCW1206-1501JB	1	
R 15	ϟ RES,CERM,1M,+-5%,.125W,200PPM,1206	746826	91637	CRCW1206-1004JB	1	
R 16	ϟ RES,CERM,390,+-5%,.125W,200PPM,1206	740498	91637	CRCW1206-3900JB	1	
U 1	ϟ IC,OPAMP,ULOW DRIFT,LOW NOISE,SO8	887120	24355	AD707KR-REEL	1	
U 2	ϟ IC,OP AMP,50MHZ,CURRENT FEEDBACK AMP	836262	64762	EL2020CN	1	
VR 1, 2	ϟ ZENER,UNCOMP,5.1V,5%,20MA,0.2W,SOT-23	837179	04713	MMBZ5231BT1	2	
VR 3	ϟ ZENER,UNCOMP,12.1V,5%,5MA,0.2W,SOT23	866822	04713	BZX84C12T1	1	
VR 4	ϟ ZENER,UNCOMP,18V,5%,7MA,0.2W,SOT-23	876433	04713	MMBZ5248BT1	1	
NOTES:	ϟ Static sensitive part.					

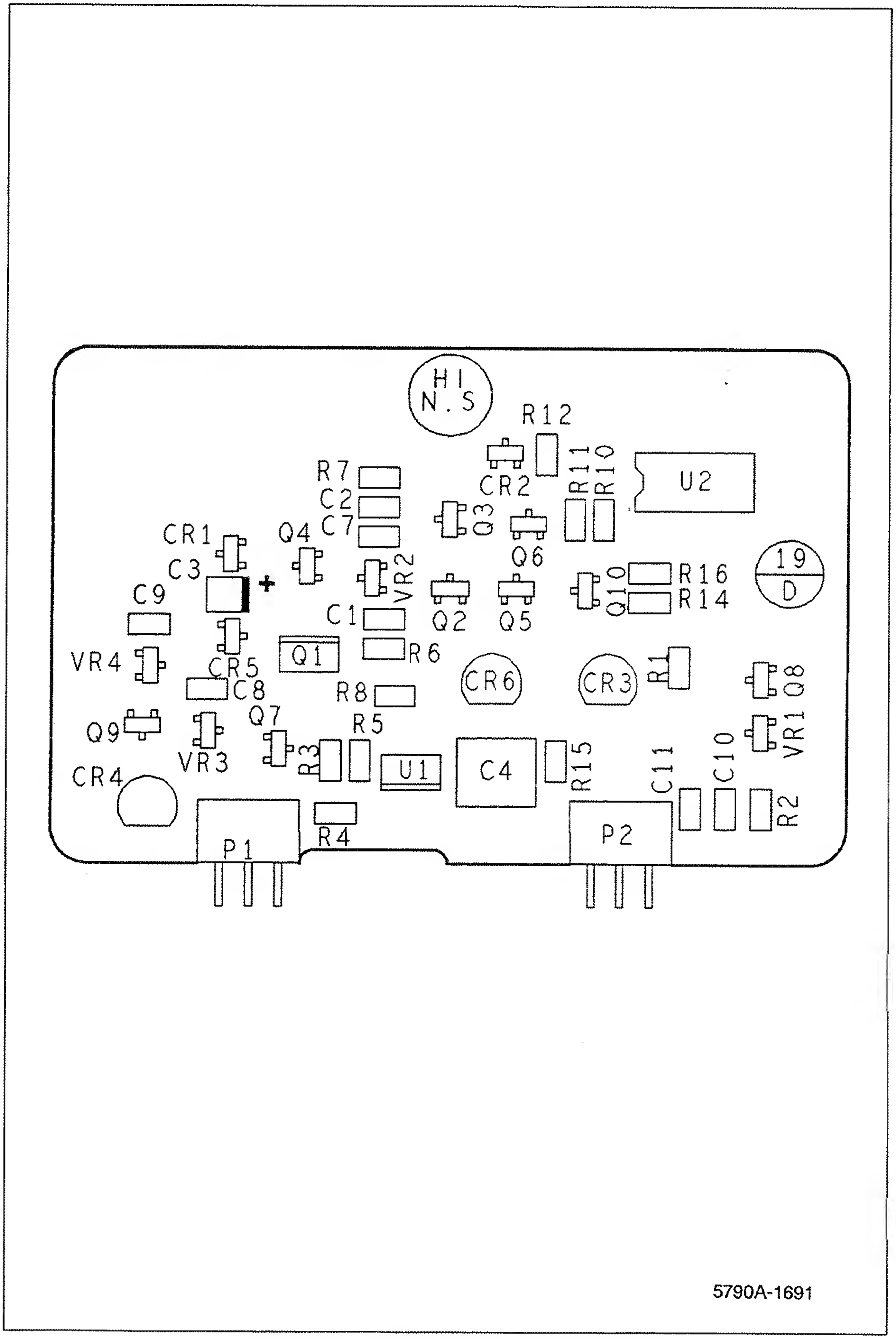

Figure 6-11. A10A1 Precision Amplifier PCA

Table 6-12. A10A2 HV Protection PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1, 2	CAP,CER,0.22UF,+80-20%,50V,Y5V,1206	740597	51406	GRM42-6Y5V221Z050PB	2	
CR 1, 2	ϟ DIODE,SI,BV=125.0V,IO=150MA,500 MW	844647	07263	XDH9912	2	
CR 3, 7, 8	ϟ DIODE,SI,BV=200V,IO=200MA,350MW,SOT23	867072	27014	MMBD1501-LO/HI	3	
CR 4- 6	ϟ DIODE,SI,BV=30V,IO=150MA,250MW	853523	04222	SR595E224ZAA	3	
P 1, 2	HEADER,2 ROW,.100CTR,RT ANG,6 PIN	912217	0AKZ5	LPEG06DR-TIR125135	2	
Q 1- 4	ϟ TRANSISTOR,SI,N-DMOS,500V,TO-92	782490	59640	VN0550N3	4	
Q 5- 8	ϟ TRANSISTOR,SI,P-MOS,500V,TO-92	782508	59640	VP0550N3	4	
Q 9- 12	ϟ TRANSISTOR,SI,NPN,SMALL SIGNAL,SOT-23	742676	04713	MMBT3904T	4	
Q 13- 16	ϟ TRANSISTOR,SI,PNP,SMALL SIGNAL,SOT-23	742684	04713	MMBT3906T	4	
R 1- 16	ϟ RES,CERM,330K,+-5%,.125W,200PPM,1206	746776	91637	CRCW1206-3303JB	16	
R 17, 20	ϟ RES,CERM,510K,+-5%,.125W,200PPM,1206	746800	91637	CRCW1206-5103JB	2	
R 18, 30	ϟ RES,CERM,220,+-5%,.125W,200PPM,1206	746347	91637	CRCW1206-2200JB	2	
R 19	ϟ RES,CERM,1M,+-5%,.125W,200PPM,1206	746826	91637	CRCW1206-1004JB	1	
R 21- 28	ϟ RES,CERM,10,+-5%,.125W,200PPM,1206	746214	91637	CRCW1206-10R0JB	8	
RT 1	THERMISTOR,DISC,NEG,200,+-5%,25C	886960	91833	RL2006-125-73-D1	1	
U 1- 4	ϟ IC, 2.5V,100 PPM T.C.,BANDGAP REF	723478	27014	LM285BYZ-2.5	4	
U 5- 7	ϟ ISOLATOR,OPTO,LED TO PHOTOVLTC SOURCE	876354	81483	PV15100	3	
NOTES:	ϟ Static sensitive part.					

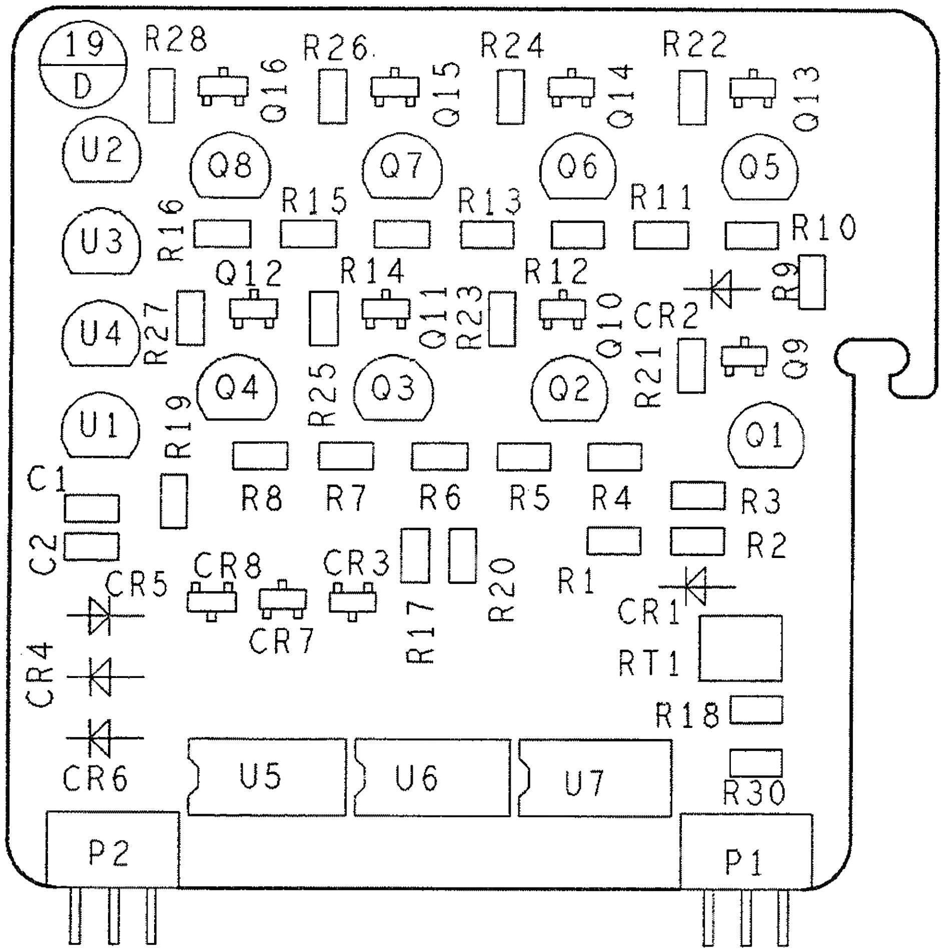

Figure 6-12. A10A2 High Voltage Protection Amplifier PCA

Table 6-13. A10A3 High-Gain Precision Amplifier PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1, 2	CAP,CER,270PF,+-10%,50V,C0G,1206	837385	04222	12065A271KAT050B	2	
C 3	CAP,TA,4.7UF,+-20%,10V,3528	867262	56289	293D475X0010B2T OR W	1	
C 4	CAP,POLYES,0.47UF,+-10%,50V,2225	913736	68919	MKS22474K50	1	
C 7- 11	CAP,CER,0.22UF,+80-20%,50V,Y5V,1206	740597	51406	GRM42-6Y5V221Z050PB	5	
CR 1, 2, 5	ϟ DIODE,SI,BV=70.0V,IO=50MA,DUAL,SOT23	742320	8A233	BAV99	3	
CR 3, 6	ϟ DIODE,SI,N-JFET,CURRENT REG,IF=2.0 MA	284927	17856	J9014	2	
CR 4	ϟ DIODE,SI,N-JFET,CURRENT REG,IF=5.3 MA	334714	17856	J9010	1	
H 1	SPACER,SWAGE,.250 RND,BR,6-32,.325	296137	55566	3045B632B14-MOD.=.325	1	
P 1, 2	HEADER,2 ROW,.100CTR,RT ANG,6 PIN	912217	0AKZ5	LPEG06DR-TIR125135	2	
Q 1	ϟ TRANSISTOR,SI,N-JFET,DUAL,SOIC	876425	17856	SST441-TR1	1	
Q 2, 3, 8, Q 9	ϟ TRANSISTOR,SI,PNP,SMALL SIGNAL,SOT-23 ϟ	742684 742684	04713	MMBT3906T	4	
Q 4- 6	ϟ TRANSISTOR,SI,NPN,SMALL SIGNAL,SOT-23	742676	04713	MMBT3904T	3	
Q 7	ϟ TRANSISTOR,SI,N-JFET,SOT23	844584	17856	SSTH20	1	
R 1	ϟ RES,CERM,180,+-5%,.125W,200PPM,1206	746321	91637	CRCW1206-1800JB02	1	
R 2	ϟ RES,CERM,6.2K,+-5%,.125W,200PPM,1206	746016	91637	CRCW1206-6201JB	1	
R 3	ϟ RES,CERM,680,+-5%,.125W,200PPM,1206	746396	91637	CRCW1206-681JB	1	
R 4, 8	ϟ RES,CERM,10K,+-5%,.125W,200PPM,1206	746610	91637	CRCW1206-1002JB	2	
R 5	ϟ RES,CERM,18K,+-5%,.125W,200PPM,1206	746636	91637	CRCW1206-1802JB	1	
R 6, 7	ϟ RES,CERM,124,+-1%,.125W,100PPM,1206	867499	91637	CRCW1206-1240FB	2	
R 10, 11	ϟ RES,CERM,432,+-1%,.125W,100PPM,1206	811885	91637	CRCW1206-4320FB	2	
R 12	ϟ RES,CERM,1K,+-5%,.125W,200PPM,1206	745992	91637	CRCW1206-1001JB	1	
R 14	ϟ RES,CERM,150,+-5%,.125W,200PPM,1206	746313	91637	CRCW1206-1500JB02	1	
U 1	ϟ IC,OPAMP,ULOW DRIFT,LOW NOISE,SO8	887120	24355	AD707KR-REEL	1	
U 2	ϟ IC,OP AMP,100MHZ,CURRENT FEEDBACK AMP	914130	64155	LT1223CN8	1	
VR 1, 2	ϟ ZENER,UNCOMP,5.1V,5%,20MA,0.2W,SOT-23	837179	04713	MMBZ5231BT1	2	
VR 3	ϟ ZENER,UNCOMP,12.1V,5%,5MA,0.2W,SOT23	866822	04713	BZX84C12T1	1	
VR 4	ϟ ZENER,UNCOMP,18V,5%,7MA,0.2W,SOT-23	876433	04713	MMBZ5248BT1	1	
NOTES:	ϟ Static sensitive part.					

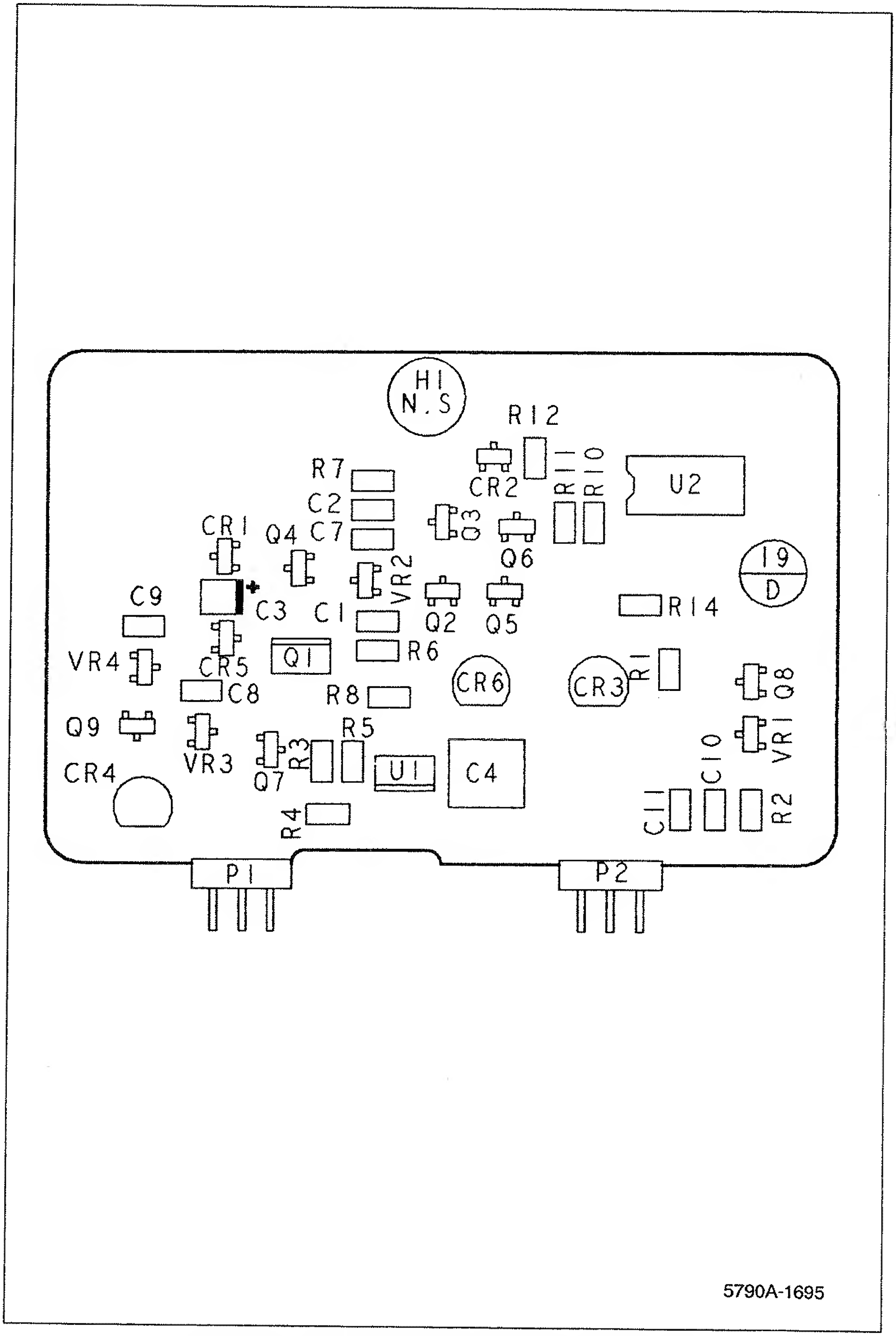

Figure 6-13. A10A3 High-Gain Precision Amplifier PCA

Table 6-14. A15 A/D Amplifier PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1, 2, 4, C 23, 25, 44	CAP,POLYES,0.22UF,+-5%,50V	747519 747519	37942	185-2-224J50AA	6	
C 3	CAP,CER,1000PK,+-20%,50V	697458	89536	697458	1	
C 5, 6	CAP,POLYES,1UF,+-10%,50V	733089	37942	185-2-105K50AA	2	
C 7, 8, 12, C 13	CAP,TA,4.7UF,+-20%,25V	807644 807644	56289	199D475X0025BG2	4	
C 9, 14	CAP,POLYES,0.01UF,+-10%,50V	715037	37942	185-2-103K50A/A	2	
C 10	CAP,CER,4.7PF,+-0.25PF,50V,C0G	721837	04222	SR215A4R7CAA	1	
C 11	CAP,CER,470PF,+-5%,50V,C0G	830430	04222	SR595A471JAA	1	
C 15, 16	CAP,CER,15PF,+-20%,50V,C0G	697524	04222	SR595A150MAA	2	
C 17	CAP,POLYPR,0.033UF,+-10%,63V	721050	68919	MKP20-333K63V	1	
C 18, 19	CAP,POLYPR,0.33UF,+-5%,50V,HERMETIC	876367	84411	JF167-334J50V	2	
C 20, 22	CAP,CER,33PF,+-5%,50V,C0G	714543	04222	SR595A330JAA	2	
C 21	CAP,CER,1000PF,+-20%,50V,X7R	697458	04222	SR595C102MAA	1	
C 24	CAP,CER,82PF,+-2%,50V,C0G	714857	04222	SR595A820GAA	1	
C 26, 27	CAP,POLYES,2200PF,+-10%,50V	832683	37942	185-2-222K50AA	2	
C 28, 29, 36, C 37	CAP,TA,10UF,+-20%,35V	816512 816512	56289	199D106X0035DG2	4	
C 30- 33	CAP,TA,22UF,+-20%,10V	658971	56289	199D226X0010CG2	4	
C 38- 40, 50- C 55, 62- 64, C 67- 70	CAP,POLYES,0.1UF,+-10%,50V	649913 649913 649913	37942	185-2-104K50AA	16	
C 41	CAP,CER,4700PF,+-20%,100V,C0G	743427	04222	SR591A472MAA	1	
C 42, 43	CAP,POLYPR,0.15UF,+-10%,100V	912688	68919	MKP20 0.15/100/10	2	
CR 1, 2	ϟ DIODE,SI,BV= 75.0V,RADIAL INSERTED	659516	15238	1N4448	2	
H 1- 4	RIVET,S-TUB,OVAL,STL,.087,.343	838458	40551	502-.087-.343	4	
K 1, 2	RELAY,ARMATURE,2 FORM C,5V,LATCH	769307	61529	DS2EML2DC5VCH284	2	
L 3, 4	CHOKE,6TURN	320911	89536	320911	2	
MP 2, 3	EJECTOR,PWB,NYLON	494724	32559	CP-66	2	
MP 4	PAD, ADHESIVE	735365	21958	735365	1	
P 115,215	CONN,DIN41612,TYPE C,RT ANG,64 PIN	807800	28213	7264-50D2TB	2	
Q 3	ϟ TRANSISTOR,SI,NPN,SMALL SIGNAL,TO-92	698225	04713	2N3904	1	
Q 4	ϟ TRANSISTOR,SI,PNP,TO92	698233	04713	2N3906	1	
Q 5	ϟ TRANSISTOR,SI,P-JFET,TO-92	852111	17856	J6006	1	
R 1, 4, 8, R 9, 17, 28, R 31	RES,CF,1K,+-5%,0.25W	780585 780585 780585	59124	CF1/4 102J	7	
R 2	RES,MF,33.2K,+-1%,0.125W,100PPM	291393	91637	CMF-55 3322F T-1	1	
R 3, 6	RES,CF,2K,+-5%,0.25W	810457	59124	CF1/4 202J	2	
R 5	RES,CF,560,+-5%,0.25W	810440	59124	CF1/4 561J	1	
R 7	RES,CF,200,+-5%,0.25W	810390	59124	CF1/4 201J	1	
R 10, 13, 48	RES,CF,330,+-5%,0.25W	830596	59124	CF1/4 331J	3	
R 11, 12, 22	RES,CF,10K,+-5%,0.25W	697102	59124	CF1/4 103J	3	
R 14	RES,MF,562,+-.1%,.125W,25PPM	853531	91637	CMF55 5620B T-1	1	
R 15	RES,MF,19.6K,+-1%,0.125W,100PPM	293746	91637	CMF-55 1962F T-1	1	
R 16, 34	RES,CF,47K,+-5%,0.25W	721787	59124	CF1/4 473J	2	
R 18- 20	RES,MF,11.8K,+-0.1%,0.125W,25PPM	344408	91637	CMF-55 1182B T-9	3	
R 21	RES,MF,4.53K,+-1%,0.125W,25PPM	851238	91637	CMF-55 4531F T-9	1	
R 23	RES,MF,40.2K,+-1%,0.125W,100PPM	720227	91637	CMF-55 4022F T-1	1	
R 24	RES,MF,3.92K,+-.1%,.125W,25PPM	844662	91637	CMF-55 3921B T-9	1	
R 25	RES,MF,39.2K,+-.1%,.125W,25PPM	706176	91637	CMF-55 3922B T-9	1	
R 26, 27	RES,CF,4.7K,+-5%,0.25W	721571	59124	CF1/4 472J	2	
R 29	RES,MF,10K,+-.1%,.125W,25PPM	706150	91637	CMF-55 1002B T-9	1	
R 30	RES,MF,2K,+-0.1%,0.125W,25PPM	340174	91637	CMF-55 2001 T-9	1	
R 32	RES,CF,1.5K,+-5%,0.25W	810432	89536	810432	1	

Table 6-14. A15 A/D Amplifier PCA (cont)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
R 33	RES,MF,124K,+-1%,0.125W,100PPM	288407	91637	CMF-55 1243F T-1	1	
R 35, 36	RES,CF,750,+-5%,0.25W	810374	59124	CF1/4 751J	2	
R 37	RES,CF,16K,+-5%,0.25W	714303	59124	CF1/4 163J	1	
R 38, 40	RES,MF,68.1K,+-1%,0.125W,100PPM	236828	91637	CMF-55 6812F T-1	2	
R 39	RES,CF,10K,+-5%,0.25W	697102	89536	697102	1	
R 41	RES,MF,147K,+-1%,0.125W,100PPM	291344	91637	CMF-55 1473F T-1	1	
R 42	RES,MF,1.27K,+-1%,0.125W,100PPM	853536	91637	CMF-55 1271F T-1	1	
R 43	RES,MF,6.34K,+-1%,0.125W,100PPM	267344	91637	CMF-55 6341F T-1	1	
R 44	RES,CF,1M,+-5%,0.25W	649970	59124	CF1/4 105J	1	
R 45	RES,MF,63.4K,+-1%,0.125W,100PPM	235382	91637	CMF-55 6342F T-1	1	
R 46	RES,MF,84.5K,+-0.5%,0.125W,100PPM	229492	91637	CMF-55 8452J T-1	1	
R 47	RES,MF,17.4K,+-1%,0.125W,100PPM	236802	91637	CMF-55 1742F T-1	1	
TP 1- 16	JUMPER,WIRE,NONINSUL,0.200CTR	816090	91984	150T1	16	
U 2	ϟ IC,OP AMP,DUAL,LO OFFST VOLT,LO-DRIFT	851704	27014	LF412ACN	1	
U 3, 19- 22	ϟ IC,OP AMP,LO-OFFSET VOLTAGE,LO-NOISE	605980	06665	OP-07DP	5	
U 5, 13- 15	ϟ IC,CMOS,QUAD BILATERAL SWITCH	910708	17856	DG444DJ	4	
U 6, 7	ϟ IC,CMOS,QUAD SPST ANALOG SWITCH	875328	17856	DG271CJ	2	
U 8	ϟ IC,CMOS,MONOSTABL/ASTABL MULTIVIBRATR	535575	27014	CD4047BC	1	
U 9	ϟ IC,CMOS,QUAD SPDT ANALOG SW,LOW CHRG	875641	64155	LTC1043CN	1	
U 10, 11	ϟ IC,OP AMP,CHOPPER STABILIZED,8 PIN	875596	39003	MAX430CPA	2	
U 16	ϟ IC,CMOS,14BIT DAC,12BIT ACC,CUR OUT	773101	24355	AD7534KN	1	
U 17	ϟ IC,OP AMP,DUAL,PRECISION,8-PIN DIP	783696	64155	LT1013CN8	1	
U 23	ϟ IC,OP AMP,MICROPOWER,DUAL, 8 PIN DIP	876495	64155	LT1078-CN8	1	
U 24	MERCURY/SATURN, ASSY TESTED PLASTIC	776195	89536	776195	1	
U 25	ϟ IC,CMOS,HEX INVERTER,UNBUFFERED	741199	01295	SN74HCU04N	1	
U 26	ϟ IC,CMOS,PROGRMBL PERIPHERAL INTERFACE	780650	34371	CP82C55A	1	
U 27	ϟ IC,BIMOS,8 CHNL HI-VOLT DRVR W/LATCH	782912	56289	UCN5801A	1	
VR 1	ϟ ZENER,UNCOMP,5.6V,5%,20MA,0.5W	820464	04713	1N5232B	1	
VR 2, 3	ϟ ZENER,UNCOMP,4.3V,5%,20.0MA,0.4W	851589	04713	1N749A	2	
VR 4, 5	ϟ ZENER,UNCOMP,7.5V,5%,20.0MA,0.4W	698688	04713	1N755ASZ2388-5TA2	2	
VR 6	ϟ ZENER,COMP,6.4V,2%,2PPM,0.5MA	393579	55801	DT-2006	1	
VR 7	ϟ ZENER,UNCOMP,15.0V,5%,8.5MA,0.4W	820415	04713	1N965B	1	
XU 24	SOCKET,PLCC,68 PIN	876334	00779	821574-1	1	
Y 1	CRYSTAL,3.84MHZ,+-0.05%,HC-18/U	650390	61429	HC-18/U-384-.05%	1	
Z 1	RES NET THN FILM TESTED	833921	89536	833921	1	
Z 2	ϟ SUBSTRATE ASSY, 4R02H	893248	89536	893248	1	
Z 3, 4	ϟ REF DIVIDER RES NET ASSY TESTED -510A	645341	89536	645341	2	
Z 6	ϟ SUBSTRATE ASSY, 4R06H	893250	89536	893250	1	
NOTES:	ϟ Static sensitive part.					

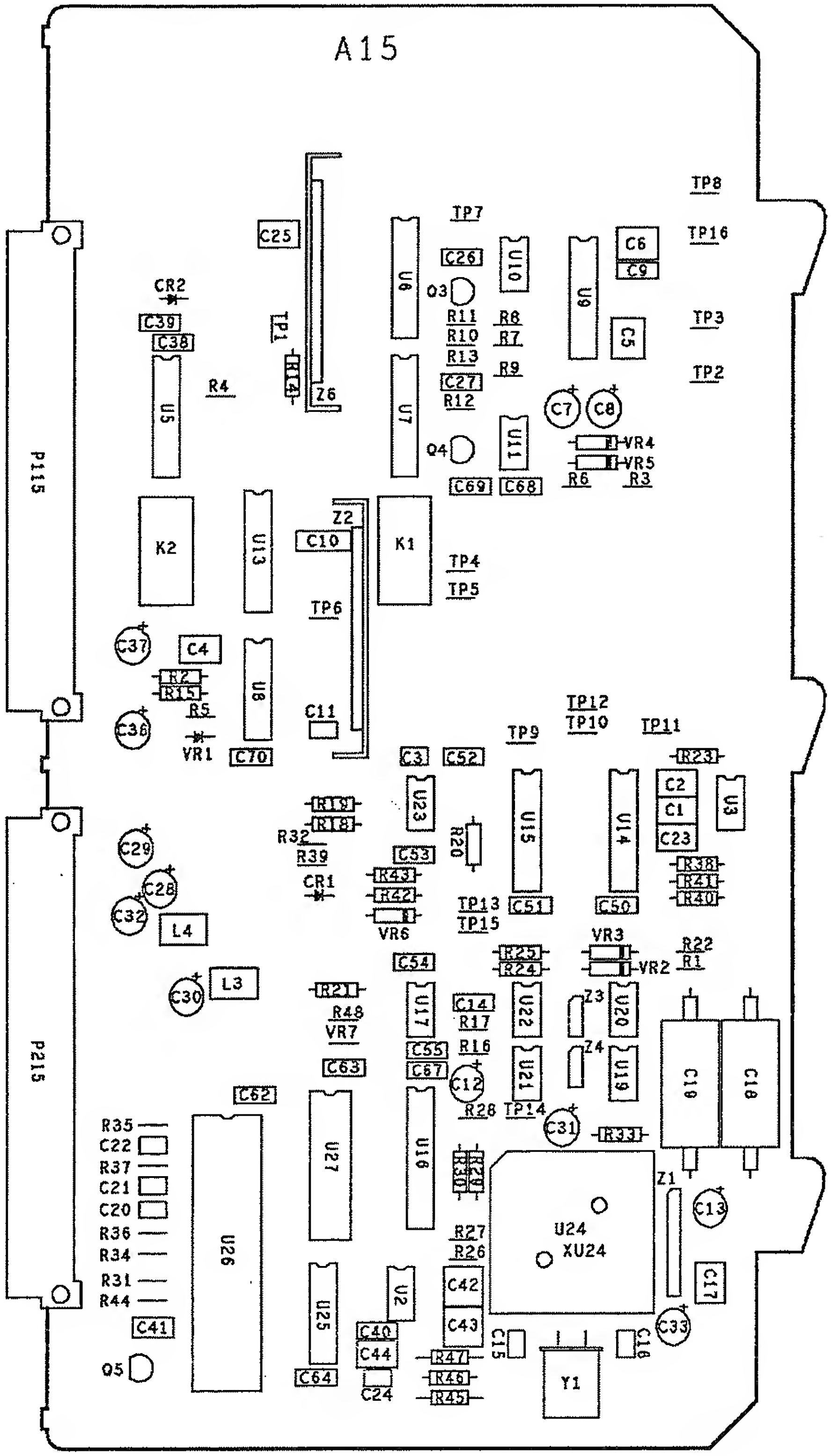

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Figure 6-14. A15 A/D Amplifier PCA

Table 6-15. A16 DAC PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
A 1	ϟ PCA, DAC FILTER SIP BURN-IN	893276	89536	893276	1	
C 1, 2, 4, C 10, 11, 17, C 18, 23- 26, C 42, 46- 49, C 53- 56, 58, C 62, 64, 65, C 105,109	CAP,CER,0.22UF,+80-20%,50V,Y5V,1206	740597 740597 740597 740597 740597 740597 740597	51406	GRM42-6Y5V221Z050PB	26	
C 12	CAP,AL,10UF,+-20%,63V,SOLV PROOF	816843	62643	KME63T10RM5X11RP	1	
C 19, 20	CAP,TA,2.2UF,+-10%,35V	697433	56289	199D225X9035BG2	2	
C 27	CAP,CER,15PF,+-20%,50V,C0G	697524	04222	SR595A150MAA	1	
C 29	CAP,CER,220PF,+-2%,100V,C0G	816728	04222	SR591A221GAA	1	
C 32	CAP,CER,0.1UF,+-10%,25V,X7R,1206	747287	04222	12063C104KAT060B	1	
C 44, 60	CAP,CER,1000PF,+-10%,50V,C0G,1206	747378	04222	12065A101KAT050B	2	
C 52,103	CAP,CER,33PF,+-10%,50V,C0G,1206	769240	04222	12065A330KAT050B	2	
C 57	CAP,CER,22PF,+-5%,50V,C0G	714550	04222	SR595A220JAA	1	
C 59, 67	CAP,CER,100PF,+-10%,50V,C0G,1206	740571	04222	12065A101KAT050B	2	
C 110,111	CAP,POLYES,0.22UF,+-5%,50V	747519	89536	747519	2	
CR 1, 4, 5	ϟ DIODE,SI,BV= 75.0V,RADIAL INSERTED	659516	15238	1N4448	3	
CR 7	ϟ DIODE,SI,N-JFET,CURRENT REG,IF=1.0 MA	832105	17856	J2900	1	
CR 14	ϟ DIODE,SI,N-JFET,CURRENT REG,IF=5.3 MA	334714	17856	J9010	1	
H 1	SCREW,PH,P,LOCK,SS,6-32,.500	320051	2M530	320051	1	
H 9- 12	RIVET,S-TUB,OVAL,STL,.087,.343	838458	40551	502-.087-.343	4	
H 21	SCREW,PH,P,LOCK,STL,4-40,.187	129882	74594	129882	1	
H 26	NUT,HEX,STL,4-40	184044	73734	8002A-NP	1	
H 28	TERM,RING 5/64 & .144,SOLDR	101055	79963	9.144-5/64.020 BRASS	1	
H 32	SHIELD, DAC, FRONT	797761	89536	797761	1	
HR 6	ϟ DC AMP HYBRID ASSY	761411	89536	761411	1	
HR 9	ϟ REFERENCE HYBRID ASSY	893334	89536	893334	1	
L 5	CHOKE,6TURN	320911	89536	320911	1	
M 3	SHIELD, DAC REAR	761429	89536	761429	1	
MP 1	MOLDED COVER, HYBRID, R-NET	775619	89536	775619	1	
MP 4	MOLDED COVER, REFERENCE HYBRID	797746	89536	797746	1	
MP 5, 6	EJECTOR,PWB,NYLON	494724	32559	CP-66	2	
MP 7, 8	HEAT DIS,PWB MT,.75X.50X.50,TO-220	816587	30161	5968B	2	
MP 10	HEAT DIS,VERT,.75X.52X.50,TO-220	811760	30161	5972B	1	
MP 11	SHIELD, DAC, FRONT, SMALL	797720	89536	797720	1	
P 116,216	CONN,DIN41612,TYPE C,RT ANG,64 PIN	807800	28213	7264-50D2TB	2	
Q 1	ϟ TRANSISTOR,SI,BV= 60V, 65W,TO-220	386128	04713	TIP120T	1	
Q 2, 3	ϟ TRANSISTOR,SI,BV=40V,40W,TO-220	369660	04713	TIP32T	2	
Q 4- 7	ϟ TRANSISTOR,SI,N-DMOS PWR FET,TO-92	782565	59640	VN0104N3	4	
Q 12, 13, 16, Q 17, 23, 24	ϟ TRANSISTOR,SI,N-JFET,HI-VOLTAGE,TO-92 ϟ	832147 832147	17856	J2907	6	
Q 30, 32	ϟ TRANSISTOR,SI,N-JFET,SOT23	844584	17856	SSTH20	2	
Q 31, 33, 35	ϟ TRANSISTOR,SI,NPN,SMALL SIGNAL,SOT-23	806463	04713	MMBT2369T	3	
Q 34	ϟ TRANSISTOR,SI,PNP,SMALL SIGNAL,SOT-23	838516	04713	MMBTH81T1	1	
R 1, 28, 33, R 39, 44	ϟ RES,CERM,4.7K,+-5%,.125W,200PPM,1206 ϟ	740522 740522	91637	CRCW1206-4701JB	5	
R 2	RES,CF,3K,+-5%,0.25W	810366	59124	CF1/4 302J	1	
R 3	RES,CF,2K,+-5%,0.25W	441469	59124	CF1/4 202J	1	
R 6	ϟ RES,CERM,910,+-5%,.125W,200PPM,1206	769257	91637	CRCW1206-9100JB	1	
R 7	ϟ RES,CERM,620,+-5%,.125W,200PPM,1206	745984	91637	CRCW1206-6200JB	1	
R 9	ϟ RES,CERM,1.8K,+-5%,.125W,200PPM,1206	746453	91637	CRCW1206-1801JB	1	
R 10, 27	RES,MF,2.49K,+-1%,0.125W,100PPM	810523	59124	MF50D2491F	2	
R 12	ϟ RES,CERM,200,+-5%,.125W,200PPM,1206	746339	91637	CRCW1206-2000JB	1	
R 13	ϟ RES,CERM,22,+-5%,.125W,200PPM,1206	746230	91637	CRCW1206-22R0JB	1	

Table 6-15. A16 DAC PCA (cont)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
R 15	RES,MF,1.21K,+-1%,0.125W,100PPM	810507	59124	MF50D1211F	1	
R 16	ϟ RES,CERM,750,+-5%,.125W,200PPM,1206	746404	91637	CRCW1206-7500JB	1	
R 24	ϟ RES,CERM,2.49K,+-1%,.125W,100PPM,1206	806448	91637	CRCW1206-2491FB	1	
R 29, 41	ϟ RES,CERM,10K,+-5%,.125W,200PPM,1206	746610	91637	CRCW1206-1002JB	2	
R 32	ϟ RES,CERM,10,+-5%,.125W,200PPM,1206	746214	91637	CRCW1206-10R0JB	1	
R 36,105	ϟ RES,CERM,1.2K,+-5%,.125W,200PPM,1206	746412	91637	CRCW1206-1201JB	2	
R 37,110	ϟ RES,CERM,12,+-5%,.125W,200PPM,1206	845458	91637	CRCW1206-12R0JB	2	
R 38	ϟ RES,CERM,1K,+-5%,.125W,200PPM,1206	745992	91637	CRCW1206-1001JB	1	
R 40	ϟ RES,CERM,100K,+-5%,.125W,200PPM,1206	740548	91637	CRCW1206-1003JB	1	
R 43	ϟ RES,CERM,3K,+-5%,.125W,200PPM,1206	746511	91637	CRCW1206-3001JB	1	
R 45	ϟ RES,CERM,2.7K,+-5%,.125W,200PPM,1206	746503	91637	CRCW1206-J2700B	1	
R 46	ϟ RES,CERM,360,+-5%,.125W,200PPM,1206	783290	91637	CRCW1206-3600JB	1	
R 47	ϟ RES,CERM,100,+-5%,.125W,200PPM,1206	746297	91637	CRCW1206-1000JB	1	
R 49	ϟ RES,CERM,270,+-5%,.125W,200PPM,1206	746354	91637	CRCW1206-2700JB	1	
R 50	ϟ RES,CERM,510,+-5%,.125W,200PPM,1206	746388	91637	CRCW1206-5100JB	1	
R 51	ϟ RES,CERM,150,+-1%,.125W,100PPM,1206	772780	91637	CRCW1206-1500FB	1	
R 53, 71	ϟ RES,CERM,5.1K,+-5%,.125W,200PPM,1206	746560	91637	CRCW1206-5101JB	2	
R 72	RES,CF,200,+-5%,0.25W	810390	59124	CF1/4 201J	1	
R 117-119,123	ϟ RES,CERM,7.5K,+-5%,.125W,200PPM,1206	746586	91637	CRCW1206-7501JB	4	
T 1	PULSE TRANSFORMER	802892	89536	802892	1	
TP 1, 3, 8, TP 12	JUMPER,WIRE,NONINSUL,0.200CTR	816090 816090	91984	150T1	4	
U 1	ϟ IC,OP AMP,DUAL,LO OFFST VOLT,LO-DRIFT	851704	27014	LF412ACN	1	
U 2	ϟ IC,OP AMP,DUAL,PRECISION,8-PIN DIP	783696	64155	LT1013CN8	1	
U 5	ϟ IC,OP AMP,POWER,IO=250MA	807917	27014	LM77000CP	1	
U 6	ϟ IC,CMOS,PROGRMBL INTERVAL TIMER,PLCC	806612	34371	CS82C54 T/R	1	
U 7	OSCILLATOR,8MHZ,TTL CLOCK	584169	91637	XO-43 B 8	1	
U 8	ϟ IC,CMOS,OCTL INV LINE DRVR,SOIC	782938	01295	SN74HC240DWR	1	
U 10	ϟ IC,COMPARATOR,HI-SPEED,14 PIN DIP	647115	18324	NE522N	1	
U 11	ϟ IC,OP AMP,SINGLE,LOW NOISE FAST,SOIC	783720	01295	TL071CDR	1	
U 12	ϟ ISOLATOR,OPTO,LED TO TRANSISTOR,DUAL	454330	25088	ILCT-6-254	1	
U 13	ϟ ISOLATOR, 20 MHZ OPTOCOUPLER	742817	28480	HCPL-2400,OPTION 100	1	
U 14	ϟ IC,CMOS,DUAL D F/F,+EDG TRG,SOIC	782995	01295	SN74HC74DR	1	
U 38	ϟ IC,OP AMP,JFET INPUT,8 PIN DIP	472779	27014	LF356N	1	
VR 2, 8	ϟ ZENER,UNCOMP,10.0V,5%,12.5MA,0.4W	810267	65940	1N961BT-88	2	
VR 3	ϟ ZENER,UNCOMP,16.0V,7.8MA,0.4W	822205	04713	1N966B	1	
VR 4	ϟ ZENER,UNCOMP,18.0V,5%,7.0MA,0.4W	810325	65940	1N967B	1	
VR 5	ϟ ZENER,UNCOMP,3.3V,5%,20.0MA,0.4W	820423	04713	1N746A	1	
VR 7	ϟ ZENER,UNCOMP,22.0V,5%,5.6MA,0.4W	811927	65940	1N969B	1	
VR 10, 12	ϟ ZENER,UNCOMP,10V,5%,20MA,0.2W,SOT-23	783704	04713	MMBZ5240T1	2	
VR 11	ϟ ZENER,UNCOMP,10.0V,5%,20.0MA,0.5W	820480	04713	1N5240B	1	
VR 13	ϟ ZENER,UNCOMP,13V,5%,9.5MA,0.5W	820456	04713	1N5243B	1	
Z 2	RES NET THIN FILM, TESTED	890244	89536	890244	1	
Z 5	RES,CERM,SIP,6 PIN,5 RES,510,+-2%	459974	91637	CSC06A-01-511G	1	
NOTES:	ϟ Static sensitive part.					

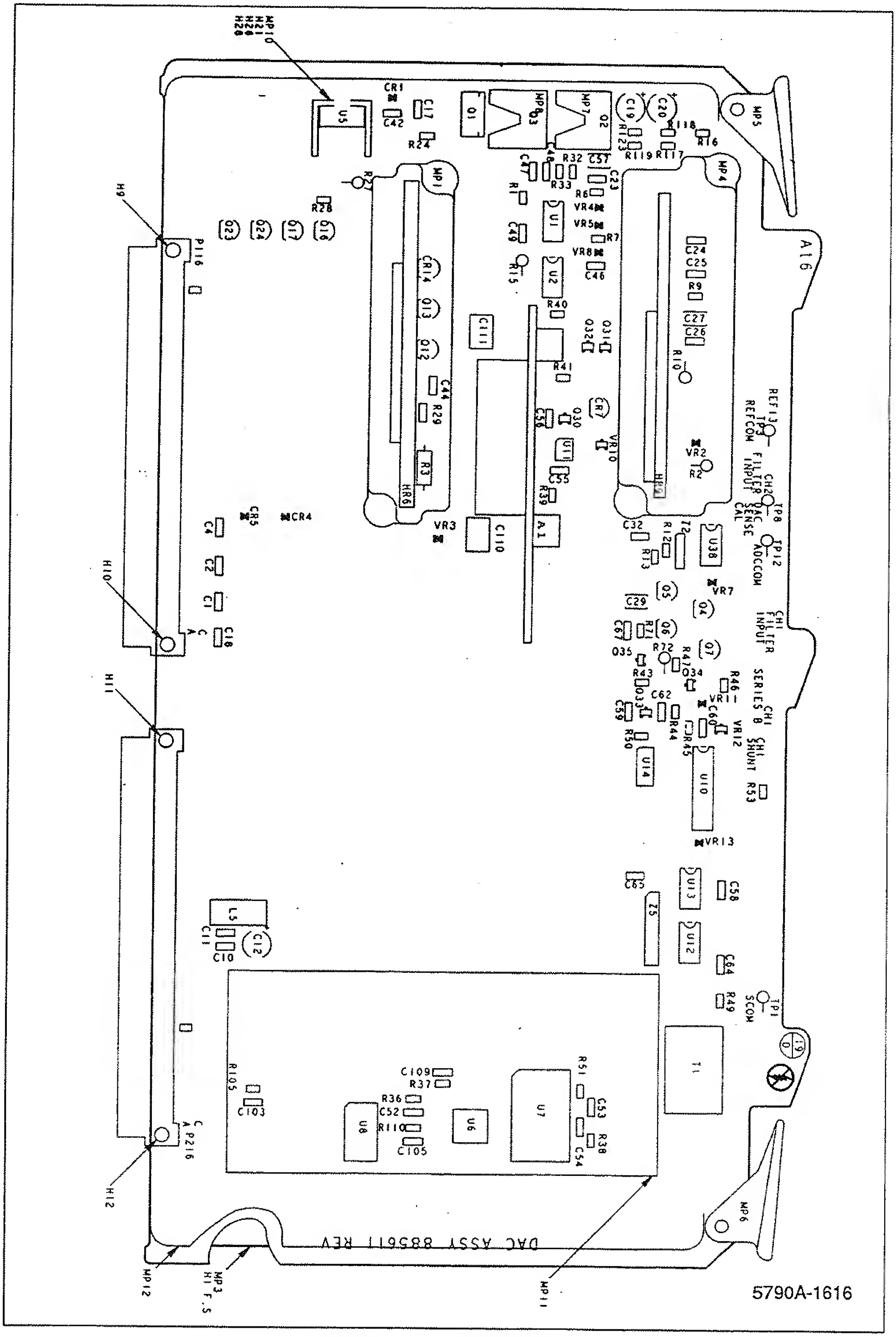

Figure 6-15. A16 DAC PCA

Table 6-16. A16A1 DAC Filter PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1, 3, 5	CAP,POLYES,0.33UF,+-20%,50V	853903	68919	MKS02-334-M-5	3	
C 10, 11	CAP,POLYPR,0.33UF,+-5%,50V,HERMETIC	876367	84411	JF167-334J50V	2	
C 12, 13	CAP,CER,0.22UF,+80-20%,50V,Y5V,1206	740597	51406	GRM42-6Y5V221Z050PB	2	
C 14	CAP,CER,100PF,+-10%,50V,C0G,1206	740571	04222	12065A101KAT050B	1	
P 21, 22	HEADER,2 ROW,.100CTR,RT ANG,6 PIN	912217	0AKZ5	LPEG06DR-TIR125135	2	
R 1	ϟ RES,CERM,15K,+-1%,.125W,100PPM,1206	769810	91637	CRCW1206-1502FB	1	
R 2	ϟ RES,CERM,8.06K,+-1%,.125W,100PPM,1206	806356	91637	CRCW1206-8061FB	1	
R 3	ϟ RES,CERM,61.9K,+-1%,.125W,100PPM,1206	821330	91637	CRCW1206-6192FB	1	
R 4	ϟ RES,CERM,22K,+-5%,.125W,200PPM,1206	746651	91637	CRCW1206-2202JB	1	
R 5	ϟ RES,CERM,11K,+-1%,.125W,100PPM,1206	867291	91637	CRCW1206-113FB	1	
U 1	ϟ IC,OP AMP,ULTRA-LOW-NOISE,SOIC	783001	01295	OP07CDR	1	
U 2	ϟ IC,OP AMP,PRECISION,LOW NOISE	782920	64155	LT1007CN8	1	
VR 1	ϟ ZENER,UNCOMP,15.0V,5%,8.5MA,0.4W	266601	04713	1N965	1	
NOTES:	ϟ Static sensitive part.					

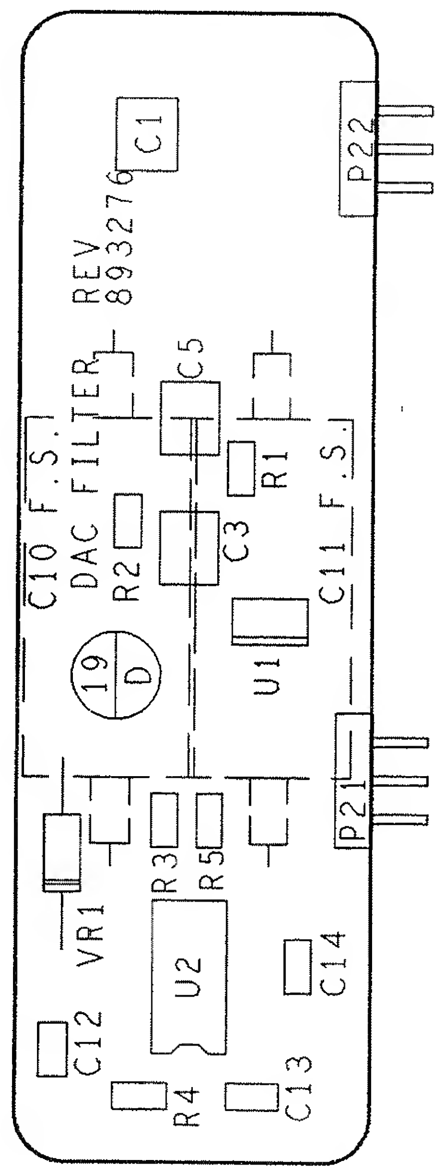

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Figure 6-16. A16A1 DAC Filter PCA

Table 6-17. A17 Regulator/Guard Crossing PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1, 2, 4, C 6, 7, 9, C 11, 12, 14, C 15, 20, 23, C 28	CAP,AL,10UF,+-20%,50V,SOLV PROOF	799437 799437 799437 799437 799437	62643	KMC50T10RM5X11RP	13	
C 3, 10	CAP,CER,0.05UF,+-20%,100V,Z5V	149161	60705	565CBA101AR503MA05	2	
C 5, 24,102	CAP,AL,22UF,+-20%,35V,SOLV PROOF	851766	62643	KRE35T22RM6X5RP	3	
C 54, 56, 59, C 60,101,104- C 107,109,110, C 112,113	CAP,POLYES,0.1UF,+-10%,50V	649913 649913 649913 649913	37942	185-2-104K50AA	13	
C 55, 58	CAP,TA,10UF,+-20%,10V	714766	56289	199D106X0010BG2	2	
C 57	CAP,TA,47UF,+-20%,10V	733246	56289	199D476X0010DG2	1	
C 61, 62	CAP,CER,22PF,+-5%,50V,C0G	714550	04222	SR595A220JAA	2	
C 67- 70	CAP,TA,22UF,+-20%,25V	357780	56289	199D220X0025DES	4	
C 71	CAP,CER,68PF,+-2%,50V,C0G	715300	04222	SR595A680GAA	1	
CR 1- 17, 20, CR 21, 24, 26, CR 27	DIODE,SI,100 PIV,1.0 AMP	742874 742874 742874	65940	1N4002A	22	
CR 36	ϟ DIODE,SI,BV= 75.0V,RADIAL INSERTED	659516	15238	1N4448	1	
H 19- 22	RIVET,S-TUB,OVAL,STL,.087,.343	838458	40551	502-.087-.343	4	
H 45- 48	SCREW,PH,P,LOCK,SS,6-32,.500	320051	2M530	320051	4	
H 49- 52	HEAT DIS ACC,NYL,TO-3	853952	13103	8181-E1	4	
H 53- 60	NUT,EXT LOCK,STL,6-32,.344OD	152819	78189	501-060800-00	8	
L 51	CHOKE, 3 TURN	452888	89536	452888	1	
MP 1, 5	HEAT DIS,PRESS ON,TO-5	418384	13103	2225B	2	
MP 6- 8, 11	HEAT DIS,HORIZ,1.88X1.40X1.25,TO-3	643593	13103	6016B-1.25	4	
MP 15	SHIELD, GUARD CROSSING	761353	89536	761353	1	
MP 16	AIR DUCT, FILTER ASSY	802884	89536	802884	1	
MP 24- 27	RIVET,POP,DOME,AL,.125X.316	807347	0CLN7	AD42H	4	
MP 35, 36	EJECTOR,PWB,NYLON	494724	32559	CP-66	2	
MP 39- 42	INSUL PART,TO-3,SI,1.650,1.140	473165	55285	7403-09FR-05	4	
MP 59- 62	INSUL PART,TRANSISTOR MOUNT,DAP,TO-5	152207	07047	10123-DAP	4	
MP 71	PAD, ADHESIVE	735365	21958	735365	1	
P 117,217	CONN,DIN41612,TYPE C,RT ANG,64 PIN	807800	28213	7264-50D2TB	2	
R 1, 4, 59	RES,MF,113,+-0.1%,0.125W,100PPM	484238	91637	CMF-55 1130B T-1	3	
R 2, 8	RES,MF,2.67K,+-1%,0.5W,100PPM	161430	91637	CMF-65 2671F T-1	2	
R 5, 11	RES,MF,203,+-.1%,.125W,100PPM	851191	91637	CMF-55 2030B T-1	2	
R 6	RES,MF,2.61K,+-0.1%,0.125W,100PPM	851571	91637	CMF-55 2611B T-1	1	
R 10	RES,MF,2.67K,+-0.1%,0.125W,25PPM	340596	91637	CMF-55 2671B T-9	1	
R 21	RES,MF,200,+-1%,0.125W,100PPM	820282	59124	MF50D2000F	1	
R 22	RES,MF,806,+-1%,0.125W,100PM	810531	59124	MF50D8060F	1	
R 23	RES,MF,1K,+-1%,0.125W,100PPM	816595	59124	MF50D1001F	1	
R 24	RES,CF,12K,+-5%,0.25W	757799	59124	CF1/4 123J	1	
R 50, 55- 57	RES,CF,620,+-5%,0.25W	641092	59124	CF1/4 621J	4	
R 52	RES,MF,1K,+-1%,0.125W,100PPM	719468	91637	CMF-55 1001F T-1	1	
R 53	RES,CF,10M,+-5%,0.25W	696971	59124	CF1/4 106J	1	
R 54	RES,CF,1.8K,+-5%,0.25W	573220	59124	CF1/4 182J	1	
R 58	RES,CF,3K,+-5%,0.25W	573279	59124	CF1/4 302J	1	
SW 51	SWITCH,PUSHBUTTON,SPST,MOMENTARY	782656	61964	B3F-1022	1	
TP 1, 4, 6, TP 8- 10, 12, TP 55, 58	JUMPER,WIRE,NONINSUL,0.200CTR	816090 816090 816090	91984	150T1	9	
U 1, 5	ϟ IC,VOLT REG,HIGH VOLTAGE	723445	27014	LM317HVH	2	
U 2	ϟ IC,VOLT REG,FIXED,+15 VOLTS,1.5 AMPS	413187	04713	MC7815CT	1	
U 3	ϟ IC,VOLT REG,FIXED,-15 VOLTS,1.5 AMPS	413179	04713	MC7915CT	1	
U 6	ϟ IC,VOLT REG,ADJ,POS,LOW DROPOUT	851717	64155	LT1085CK	1	

Table 6-17. A17 Regulator/Guard Crossing PCA (cont)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
U 7	ϟ IC,VOLT REG,ADJ,NEG,LOW DROPOUT	851720	64155	LT1033CK	1	
U 8	ϟ IC,VOLT REG,FIXED,+5 VOLTS,1.0 A,TO-3	327981	27014	LM309	1	
U 11	ϟ IC,VOLT REG,HIGH VOLTAGE	723353	27014	LM317HVK	1	
U 12	ϟ IC,VOLT REG,FIXED,-5 VOLTS,1.5 AMPS	394551	04713	MC7905CT	1	
U 51	ϟ IC,CMOS,HEX INVERTER,UNBUFFERED	741199	01295	SN74HCU04N	1	
U 52	ϟ IC,CMOS,OCTL LINE DRVR W/3-ST OUT	741892	01295	SN74HCT244N	1	
U 53	ϟ IC,CMOS,3-8 LINE DECODER/DEMUX	799478	01295	SN74HC137N	1	
U 55	ϟ IC,CMOS,OCTAL BUS TRANSCEIVER	722017	27014	MM74HCT245N	1	
U 56	ϟ IC,CMOS,8-BIT MPU,2.0 MHZ,256 BYT RAM	876326	62786	HD63B03YP	1	
U 57	ϟ IC,TTL,DUAL AND DRVR W/OPEN COLLECTOR	393959	01295	SN75451BP	1	
U 58	ϟ IC,PROG ARRAY LOGIC,PRGMD,5790A-90780	904719	24355	904719	1	
U 59, 63	ϟ IC,CMOS,14 STAGE BINARY COUNTER	807701	04713	MC74HC4020N	2	
U 60	ϟ IC,VOLT SUPERVISOR,4.55V SENSE INPUT	780577	01295	TI7705ACP	1	
U 62	ϟ IC,CMOS,8K X 8 STAT RAM,120 NSEC	783332	12581	HM6264LP-12	1	
U 64	ϟ EPROM, PROGRAMMED 27C256, U64	885673	89536	885673	1	
U 65	ϟ IC,CMOS,DUAL ASYNC REC/TRAN,28 PIN	876318	18324	SCC2692AC1N28	1	
XU 58	SOCKET,IC,24 PIN	812198	00779	2-641932-3	1	
XU 64	SOCKET,IC,28 PIN	448217	91506	228-AG39D	1	
Y 52	CRYSTAL,7.3728MHZ,+-1,%,HC-18U	742049	61429	HC-18U- 073	1	
Z 1, 3	RES,CERM,SIP,8 PIN,4 RES,10K,+-2%	513309	91637	CSC08A-03-103G	2	
Z 2	RES,CERM,SIP,10 PIN,5 RES,10K,+-2%	529990	91637	CSC10A-03-103G	1	
Z 51	RES,CERM,DIP,16 PIN,15 RES,10K,+-5%	355305	91637	MDP16-03-103J	1	
Z 52	RES,CERM,SIP,8 PIN,4 RES,4.7K,+-2%	573881	91637	CSC08A-03-472G	1	
Z 53, 54	RES,CERM,SIP,10 PIN,5 RES,33,+-2%	622761	91637	CSC10A-03-330G	2	
Z 55	RES,CERM,SIP,6 PIN,5 RES,22K,+-2%	520122	91637	CSC06A-01-223G	1	
NOTES:	ϟ Static sensitive part.					

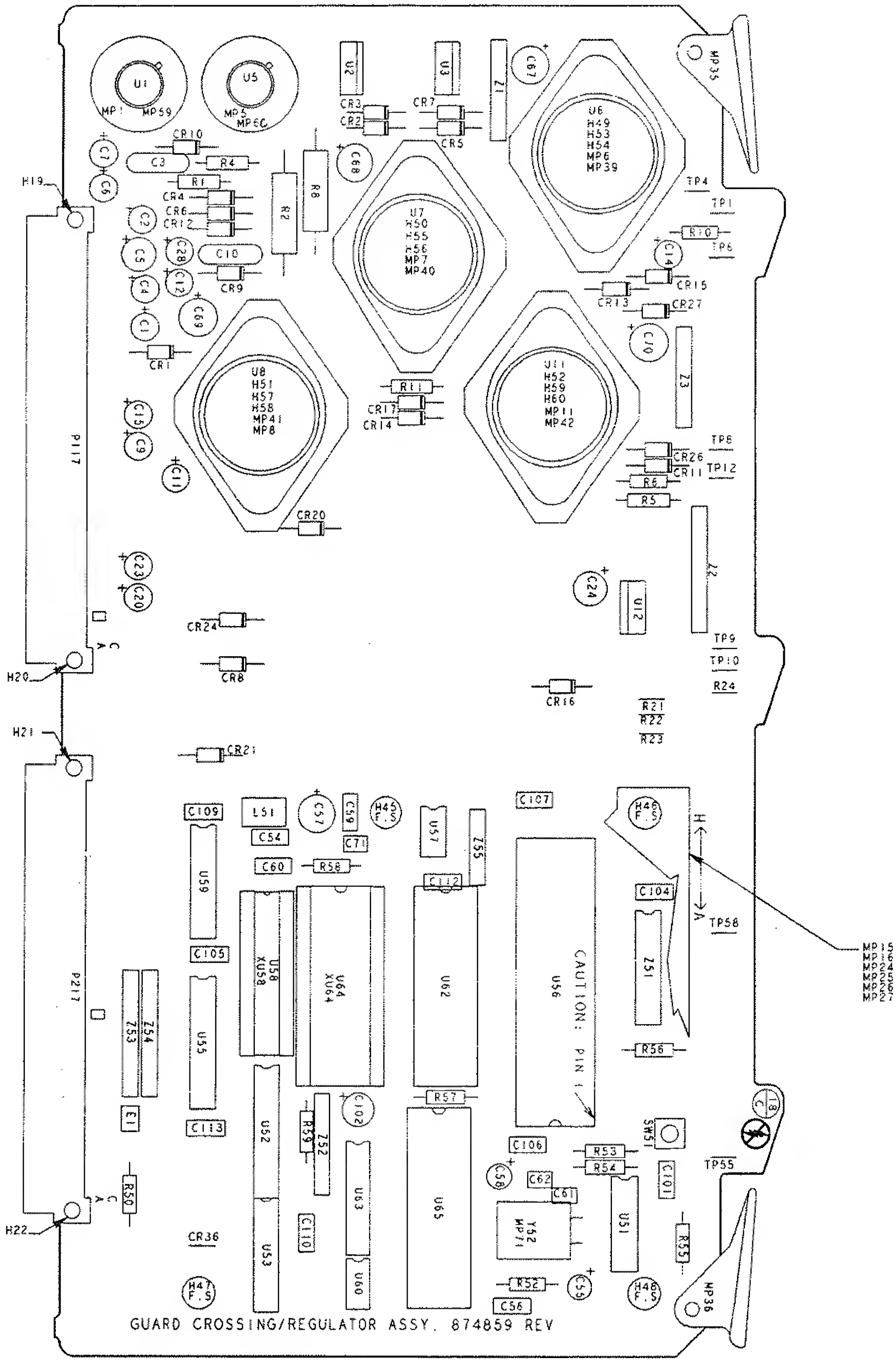

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Figure 6-17. A17 Regulator/Guard Crossing PCA

Table 6-18. A18 Filter PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1, 10, 17	CAP,POLYES,0.22UF,+-5%,50V	747519	37942	185-2-224J50AA	3	
C 2, 3	CAP,AL,6800UF,+30-20%,25V,SOLV PROOF	782466	62643	KME25VN682M30X25LLV	2	
C 4, 6	CAP,AL,1000UF,+-20%,50V,SOLV PROOF	782391	62643	KME50T102M16X25MC	2	
C 5, 19	CAP,AL,2200UF,+-20%,25V,SOLV PROOF	782383	62643	KME25T222M16X25MC	2	
C 9, 18	CAP,AL,330UF,+-20%,100V,SOLV PROOF	816785	62643	KME100T331M16X25MC	2	
C 11	CAP,AL,220UF,+-20%,25V,SOLV PROOF	816793	62643	KME25T221M8X11.5RP	1	
C 12, 22	CAP,AL,22UF,+-20%,35V,SOLV PROOF	817056	62643	KMA35T220M6X7FT	2	
C 13- 16	CAP,AL,3300UF,+30-20%,50V,SOLV PROOF	782458	62643	KME50VN332M30X30LLV	4	
C 20	CAP,AL,10UF,+-20%,63V,SOLV PROOF	816843	62643	KME63T10RM5X11RP	1	
C 21	CAP,AL,470UF,+-20%,50V,SOLV PROOF	747493	62643	KMC50VB471M16X25MC	1	
C 23	CAP,POLYES,1UF,+-10%,50V	733089	37942	185-2-105K50AA	1	
CR 1, 2, 4, CR 5, 8, 10, CR 12, 13	DIODE,SI,150 PIV,5.0 AMP	523720 523720 523720	12969	UES1303	8	
CR 3, 14	DIODE,SI,RECT,BRIDGE,BV=100V,IO=2.0A	392910	09214	2KBP01M	2	
CR 7	DIODE,SI,RECT,BRIDGE,BV=200V,IO=1.5A	296509	30800	KBP 02M	1	
CR 9, 16, 18	DIODE,SI,100 PIV,1.0 AMP	742874	65940	1N4002A	3	
CR 11, 15, 17	DIODE,SI,RECT,BRIDGE,BV=50V,IO=3.0A	586115	30800	KBL 005	3	
CR 19	ϟ THYRISTOR,SI,TRIAC,VBO=200V,8.0A	413013	04713	T2800BT	1	
F 1, 2, 8	FUSE,8X8.5MM,1.6A,250V,SLOW,RADIAL	816488	0JR59	19372-TPRL-1.600	3	
F 4, 7, 9	FUSE,8X8.5MM,0.5A,250V,SLOW,RADIAL	831990	0JR59	19372-TPRL-0.500	3	
F 6	FUSE,8X8.5MM,0.315A,250V,SLOW,RADIAL	832337	0JR59	19372-TPRL-0.315	1	
H 6- 9	RIVET,S-TUB,OVAL,STL,.087,.343	838458	40551	502-.087-.343	4	
MP 2	FOOT,RUBBER,ADHES,BLK,.50 SQ,.12 THK	543488	28213	SJ-5008	1	
MP 3	HEAT DIS,PRESS ON,TO-5	418384	13103	2225B	1	
MP 4, 5	EJECTOR,PWB,NYLON	494724	32559	CP-66	2	
MP 10	INSUL PART,TRANSISTOR MOUNT,DAP,TO-5	152207	07047	10123-DAP	1	
P 118,218	CONN,DIN41612,TYPE C,RT ANG,64 PIN	807800	28213	7264-50D2TB	2	
R 1	RES,CC,560,+-5%,1W	266361	01121	GB5615	1	
R 2, 5	RES,CC,20K,+-5%,0.5W	109041	01121	EB2035	2	
TP 1- 6, 8, TP 10- 21	JUMPER,WIRE,NONINSUL,0.200CTR	816090 816090	91984	150T1	19	
U 1	ϟ IC, VOLT REG,FIXED,-5 VOLTS,0.5 AMPS	816322	27014	LM320H-5.0	1	
U 2	ϟ IC,VOLT REG,FIXED,+5 VOLTS,0.1 AMPS	816355	27014	LM78L05ACH	1	
U 3	ϟ IC,VOLT REG,FIXED,-18 VOLTS,1.5AMPS	845474	04713	MC7918CT	1	
VR 20, 21	ϟ ZENER,UNCOMP,82.0V,5%,1.5MA,0.5W	844977	04713	1N5268B	2	
Z 1- 3	RES,CERM,SIP,10 PIN,5 RES,10K,+-2%	529990	91637	CSC10A-03-103G	3	
NOTES:	ϟ Static sensitive part.					

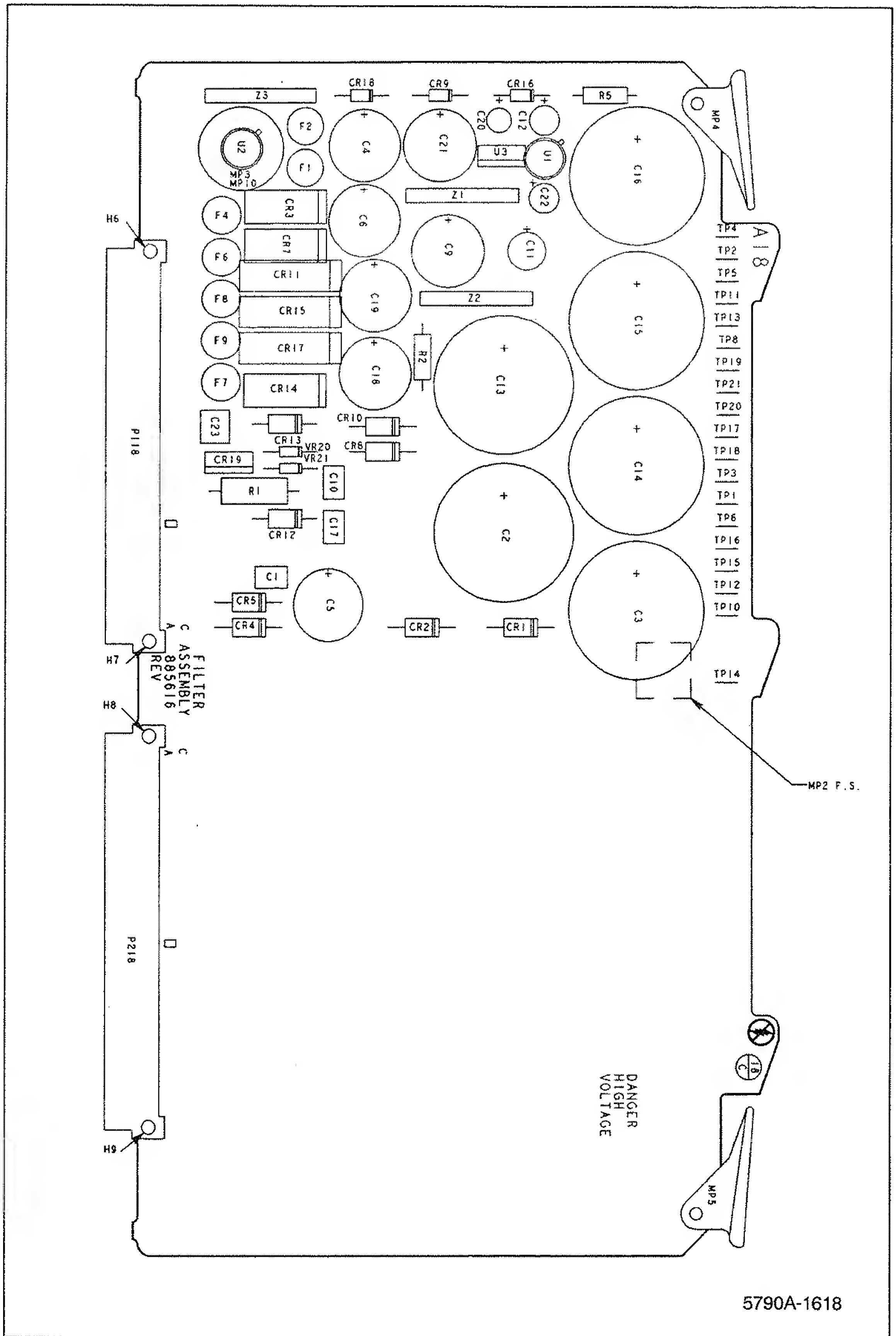

Figure 6-18. A18 Filter PCA

Table 6-19. A19 Digital Power Supply PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1	CAP,AL,470UF,+-20%,160V,SOLV PROOF	816835	62643	KME160VN471M30X30LLV	1	
C 2	CAP,AL,10UF,+-20%,160V,SOLV PROOF	817064	62643	KME160T10RM10X16MC	1	
C 3	CAP,AL,330UF,+-20%,100V,SOLV PROOF	816785	62643	KME100T331M16X25MC	1	
C 4, 9	CAP,AL,10UF,+-20%,63V,SOLV PROOF	816843	62643	KME63T10RM5X11RP	2	
C 5, 11	CAP,CER,0.10UF,+-20%,50V,X7R	853650	04222	SR595C104MAA	2	
C 6	CAP,AL,10000UF,+-20%,25V,SOLV PROOF	816819	62643	SME25VN103M30X0LLV	1	
C 7	CAP,AL,6800UF,+30-20%,25V,SOLV PROOF	782466	62643	KME25VN682M30X25LLV	1	
C 8	CAP,AL,2.2UF,+-20%,50V,SOLV PROOF	816868	62643	KME50T2R2M5X11RP	1	
C 10	CAP,AL,22UF,+-20%,35V,SOLV PROOF	817056	62643	KMA35T220M6X7FT	1	
C 12, 13	CAP,AL,22000UF,+-20%,16V,SOLV PROOF	822379	62643	SME16VN223M35X30LLV	2	
C 14, 16, 19- C 23	CAP,CER,0.22UF,+-20%,50V,X7R	853648 853648	04222	SR325C224MAA	7	
C 15	CAP,AL,100UF,+-20%,16V,SOLV PROOF	816850	62643	KME16T101M6.3X11RP	1	
C 17	CAP,POLYPR,0.047UF,+-10%,630V	500827	37942	171-473K630AH	1	
C 18	CAP,POLYPR,0.047UF,+-10%,160V	446773	37942	171473K160BC	1	
C 24, 25	CAP,CER,0.022UF,+80-20%,500V,Z5U	740340	51406	RPE113-901E223Z9	2	
CR 1- 4, 9- CR 12	DIODE,SI,200 PIV,1.0 AMP	586644 586644	04713	1N4935	8	
CR 8, 16, 21- CR 24, 29- 34	DIODE,SI,100 PIV,1.0 AMP	742874 742874	65940	1N4002A	12	
CR 13	ϟ DIODE,N-JFET,CURRENT REG,IF=3.0 MA	852137	17856	J9009	1	
CR 17- 20	DIODE,SI,50 PIV,1.0 AMP	379412	04713	1N4933	4	
CR 25- 28	DIODE,SI,150 PIV,5.0 AMP	523720	12969	UES1303	4	
CR 35	ϟ DIODE,GER,BV=66 V,IO=50MA	180505	66891	1N276	1	
F 1	FUSE,8X8.5MM,0.315A,250V,SLOW,RADIAL	832337	0JR59	19372-TPRL-0.315	1	
F 2	FUSE,8X8.5MM,0.125A,250V,SLOW,RADIAL	832261	0JR59	19372-TPRL-0.125	1	
F 3, 4	FUSE,8X8.5MM,2A,250V,SLOW,RADIAL	806331	0JR59	19372-TPRL-2.000	2	
F 5	FUSE,8X8.5MM,3.15A,250V,SLOW,RADIAL	832253	0JR59	19372-TPRL-3.150	1	
H 2	SCREW,PH,P,LOCK,SS,4-40,.375	256164	74594	256164	1	
H 3, 4	HEAT DIS,CLIP,1.00,1.18,.50,TO-220	643353	13103	6038B-TT	2	
H 5	HEAT DIS,VERT FINS,TO-3	342675	13103	6003-B-2	1	
H 6, 7	RIVET,S-TUB,OVAL,STL,.087,.343	838458	40551	502-.087-.343	2	
H 11	SCREW,PH,P,LOCK,SS,4-40,.437	403782	74594	403782	1	
L 1- 6	CHOKE,6TURN	320911	89536	320911	6	
L 7	INDUCTOR, 33 UH	813485	89536	813485	1	
L 8	TRANSFORMER, PULSE	660589	89536	660589	1	
M 1, 2	FOOT,RUBBER,ADHES,GRY,.44 DIA,.20 THK	358341	28213	SJ-5003	2	
MP 8, 27	NUT,HEX,STL,4-40	110635	89536	110635	2	
MP 9, 10	NUT,EXT LOCK,STL,6-32,.344OD	152819	78189	501-060800-00	2	
MP 11, 12	GROMMET,SLOT,RUBBER,.438,.062	853291	73734	113006	2	
MP 13, 14	EJECTOR,PWB,NYLON	494724	32559	CP-66	2	
MP 15, 26	HEAT DIS,VERT,1.00X1.375X0.50,TO-220	831099	13103	6098B-P2	2	
MP 16	HEAT,DIS,ACC,NYL,TO-3	851907	13103	8182-E1	1	
MP 21	INSUL PART,POWER,SI,.750,.500	534453	55285	7403-09FR-54	1	
MP 24	INSUL PART,TO-3,SI,1.650,1.140	473165	55285	7403-09FR-05	1	
MP 28, 29	SCREW,PH,P,LOCK,STL,6-32,.250	152140	73734	19042	2	
MP 30, 31	SPACER,SWAGE,.250 RND,BR,6-32,.125	435578	55566	3045B632B14	2	
P 119	CONN,DIN41612,TYPE C,RT ANG,64 PIN	807800	28213	7264-50D2TB	1	
Q 1	ϟ TRANSISTOR,SI,BV=200V,80W,TO-3	261347	04713	MJ410	1	
Q 2, 6	ϟ TRANSISTOR,SI,NPN,HI-VOLTAGE	370684	04713	MPSA42	2	
Q 3, 7- 10	ϟ TRANSISTOR,SI,BV=300V, 10W,TO-202	381731	04713	MPSU10	5	
Q 4	ϟ TRANSISTOR,SI,VB=200V,10W,TO-5	276899	04713	2N5415	1	
Q 5	ϟ TRANSISTOR,SI,BV= 60V, 65W,TO-220	386128	04713	TIP120T	1	
R 1	RES,CF,5.1,+-5%,0.25W	640995	59124	CF1/4 5R1J	1	

Table 6-19. A19 Digital Power Supply PCA (cont)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
R 2	RES,CF,2K,+-5%,0.25W	573238	59124	CF1/4 202J	1	
R 3, 12	RES,CF,100K,+-5%,0.25W	573584	59124	CF1/4 104J	2	
R 4	RES,CC,4.7K,+-5%,0.25W	148072	01121	CB4725	1	
R 5	RES,CF,12,+-5%,0.25W	442178	59124	CF1/4 120J	1	
R 6	RES,CC,10K,+-10%,2W	110106	01121	GB1031	1	
R 7	RES,CC,2,+-5%,0.5W	218735	01121	EB2R05	1	
R 8	RES,CF,120K,+-5%,0.25W	573592	59124	CF1/4 124J	1	
R 9, 11	RES,CF,33K,+-5%,0.25W	573485	59124	CF1/4 333J	2	
R 10	RES,CF,51K,+-5%,0.25W	573535	59124	CF1/4 513J	1	
R 13	RES,CC,10K,+-5%,0.25W	148106	01121	CB1035	1	
TP 1- 5, 8, TP 10, 12, 13	JUMPER,WIRE,NONINSUL,0.200CTR	816090 816090	91984	150T1	9	
U 1	ϟ IC,VOLT REG,FIXED,+12 VOLTS,1.5 AMPS	413195	04713	MC7812CT	1	
U 2	ϟ IC,VOLT REG,FIXED,-12 VOLTS,1.5 AMPS	381665	04713	MC7912CT	1	
U 3	ϟ IC,VOLT REG,FIXED,5 VOLTS,2 AMPS	816918	S3385	SI-3052V	1	
VR 5	ϟ ZENER,UNCOMP,6.2V,5%,20.0MA,0.4W	698662	04713	IN753ASZ2388-3TA2	1	
VR 6	ϟ ZENER,UNCOMP,36.0V,5%,3.4MA,0.4W	186163	04713	1N974	1	
VR 7	ϟ ZENER,UNCOMP,39.0V,5%,3.2MA,0.4W	831248	04713	1N975B	1	
VR 14, 15	ϟ ZENER,UNCOMP,18.0V,5%,7.0MA,0.4W	327973	04713	1N967	2	
NOTES:	ϟ Static sensitive part.					

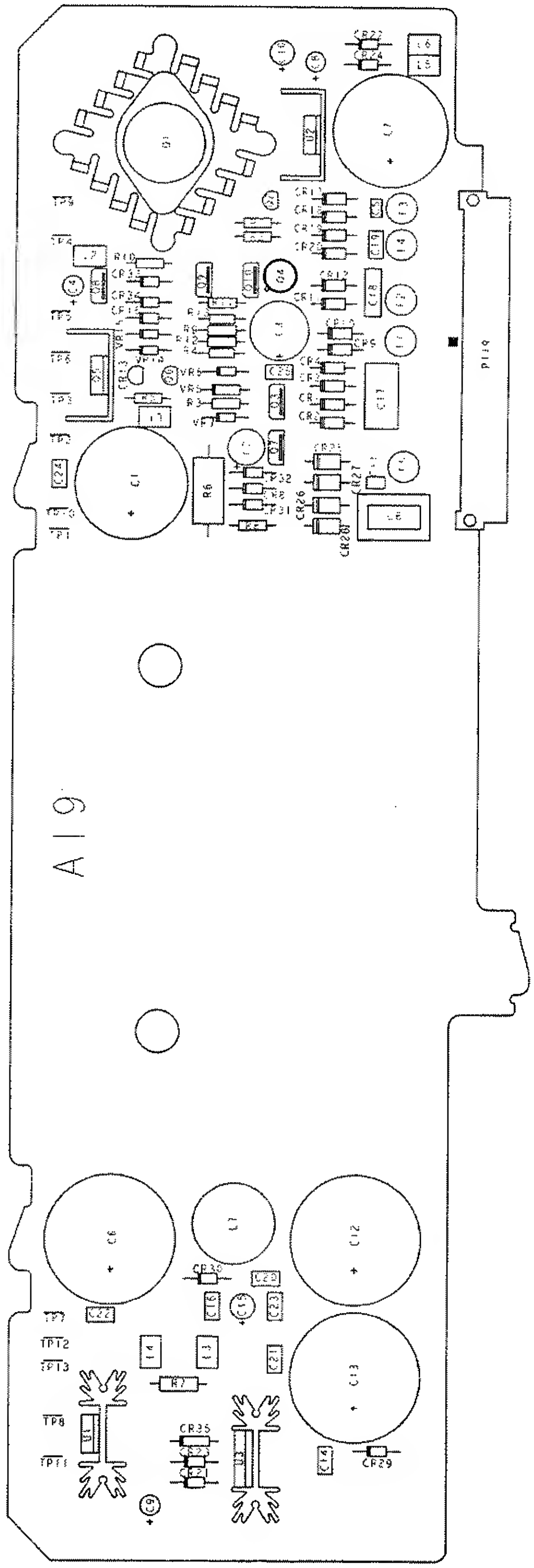

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Figure 6-19. A19 Digital Power Supply PCA

Table 6-20. A20 CPU PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
BT 1	BATTERY,LITHIUM,3.0V,0.500AH	821439	7X302	ES1045-01	1	
C 1	CAP,TA,220UF,+-20%,10V	474288	56289	199D227X0010FA2	1	
C 2- 4, 6, C 101-106,108- C 111,113,115- C 120,122-133, C 143-145,152	CAP,POLYES,0.1UF,+-10%,50V	649913 649913 649913 649913 649913	37942	185-2-104K50AA	37	
C 5	CAP,TA,15UF,+-20%,20V	807610	56289	199D156X0020DG2	1	
C 8- 11	CAP,CER,22PF,+-2%,50V,C0G	714832	04222	SR595A220GAA	4	
C 12, 13	CAP,POLYES,0.22UF,+-5%,50V	747519	89536	747519	2	
C 17	CAP,AL,47UF,+-20%,35V,SOLV PROOF	643312	62643	LR35VB470M10X15LLV	1	
C 80	CAP,CER,0.22UF,+80-20%,50V,Z5U	649939	04222	SR595E224ZAA	1	
C 81, 82	CAP,CER,120PF,+-5%,50V,C0G	721142	04222	SR595A121JAA	2	
C 100	CAP,TA,2.2UF,+-20%,16V	706804	56289	199D225X0016AE2	1	
CR 1	LED, RED, T1/T1-3/4,5MM LEAD SPACING	723486	25088	LS3360-KNE-7501	1	
CR 2, 3, 7	DIODE,SI,100 PIV,1.0 AMP	742874	65940	1N4002A	3	
CR 4- 6, 8	ϟ DIODE,SI,SCHOTTKY BARRIER,SMALL SIGNL	313247	28480	5082-6264 T25	4	
H 3- 6	RIVET,S-TUB,OVAL,STL,.087,.343	838458	40551	502-.087-.343	4	
L 80, 81	CHOKE, 3 TURN	452888	89536	452888	2	
M 3, 4	FOOT,RUBBER,ADHES,GRY,.44 DIA,.20 THK	358341	28213	SJ-5003	2	
MP 1, 2	EJECTOR,PWB,NYLON	494724	32559	CP-66	2	
MP 7, 8	PAD, ADHESIVE	735365	21958	735365	2	
P 120,220	CONN,DIN41612,TYPE C,RT ANG,64 PIN	807800	28213	7264-50D2TB	2	
R 1, 3	RES,CF,470,+-5%,0.25W	573121	59124	CF1/4 471J	2	
R 4	RES,CF,10M,+-5%,0.25W	696971	59124	CF1/4 106J	1	
R 5	RES,CF,1.8K,+-5%,0.25W	573220	59124	CF1/4 182J	1	
R 6	RES,CF,6.2K,+-5%,0.25W	573345	59124	CF1/4 622J	1	
R 51- 54	RES,MF,5.11K,+-1%,0.125W,100PPM	720342	91637	CMF-55 5111F T-1	4	
R 55	RES,MF,10K,+-1%,0.125W,100PPM	719476	91637	CMF-55 1002F T-1	1	
R 56, 57	RES,MF,1K,+-1%,0.125W,100PPM	719468	91637	CMF-55 1001F T-1	2	
R 58, 59	RES,MF,39.2K,+-1%,0.125W,25PPM	312207	91637	CMF-55 3922F T-9	2	
R 60, 61	RES,MF,1M,+-1%,0.125W,100PPM	719492	91637	CMF-55 1004F T-1	2	
R 82	RES,CF,150,+-5%,0.25W	573030	59124	CF1/4 151J	1	
SW 1	SWITCH,PUSHBUTTON,SPST,MOMENTARY	782656	61964	B3F-1022	1	
T 51	RF TRANSFORMER 8 MHZ	813477	89536	813477	1	
TP 1, 3- 12	JUMPER,WIRE,NONINSUL,0.200CTR	816090	91984	150T1	11	
U 1	ϟ IC,VOLT SUPERVISOR,4.55V SENSE INPUT	780577	01295	TI7705ACP	1	
U 2	ϟ IC,LSTTL,HEX INVERTER W/OPEN COLLECT	394536	01295	SN74LS05N	1	
U 3	ϟ IC,CMOS,HEX INVERTER,UNBUFFERED	741199	01295	SN74HCU04N	1	
U 4, 11	ϟ IC,CMOS,14 STAGE BINARY COUNTER	807701	04713	MC74HC4020N	2	
U 5	ϟ IC,CMOS,PROG LOG,35NS,5700A-90760	845271	89536	845271	1	
U 6	ϟ IC,CMOS,PROG LOGIC,25NS,5700A-90761	845250	89536	845250	1	
U 8	ϟ IC,CMOS,16 BIT MPU,8 MHZ,DIP	816926	04713	MC68HC000P-8	1	
U 9	ϟ IC,CMOS,QUAD 2 INPUT OR GATE	817312	04713	MC74HC32N	1	
U 10	ϟ IC,CMOS,PROG LOGIC,35NS,5700A-90762	845268	89536	845268	1	
U 13	IC,CMOS,32KX8 EEPROM,250NS	875260	33297	UPD28C256C-25	1	
U 15	ϟ EPROM, PROGRAMMED 27010, U15	893206	89536	893206	1	
U 16	ϟ EPROM, PROGRAMMED 27010, U16	893214	89536	893214	1	
U 17	ϟ EPROM, PROGRAMMED 27010, U17	893219	89536	893219	1	
U 18	ϟ EPROM, PROGRAMMED 27010, U18	893222	89536	893222	1	
U 19- 22	ϟ IC,CMOS,32K X 8 STATIC RAM,120 NSEC	800250	33297	D43256C12L	4	
U 25, 27- 29	ϟ IC,CMOS,OCTL LINE DRVR W/3-ST OUT	741892	01295	SN74HCT244N	4	
U 26, 30	ϟ IC,CMOS,OCTAL BUS TRANSCEIVER	722017	27014	MM74HCT245N	2	
U 31	ϟ IC,CMOS,DUAL CHANNEL UART (DUART)	799494	66419	XLS68C681C	1	

Table 6-20. A20 CPU PCA (cont)

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
U 32	⚡ IC,TTL,DUAL AND DRVR W/OPEN COLLECTOR	393959	01295	SN75451BP	1	
U 33	⚡ IC,CMOS,CLOCK CALENDAR	807693	34371	ITS9263	1	
U 52	⚡ IC,OP AMP,QUAD,14 PIN DIP	402669	27014	LM324N	1	
X 5, 6, 10	SOCKET,IC,24 PIN	812198	00779	2-641932-3	3	
X 15- 18	SOCKET,IC,32 PIN	807156	00779	2-644018-3	4	
XU 13	SOCKET,IC,28 PIN	448217	91506	228-AG39D	1	
Y 1	CRYSTAL,7.3728MHZ,+-1,%,HC-18U	742049	61429	HC-18U- 073	1	
Y 3	CRYSTAL,32.768KHZ,+-5PPM	811943	61429	FOX-032	1	
Z 1	RES,CERM,DIP,16 PIN,15 RES,3.3K,+-5%	837666	91637	MDP16-01-332J	1	
Z 2, 3	RES,CERM,DIP,16 PIN,15 RES,4.7K,+-5%	416834	91637	MDP16-01-472J	2	
Z 4	RES,CERM,SIP,10 PIN,5 RES,10K,+-2%	529990	91637	CSC10A-03-103G	1	
Z 5	RES,CERM,DIP,14 PIN,13 RES,100K,+-5%	404624	91637	MDP14-01-104J	1	
NOTES:	⚡ Static sensitive part.					

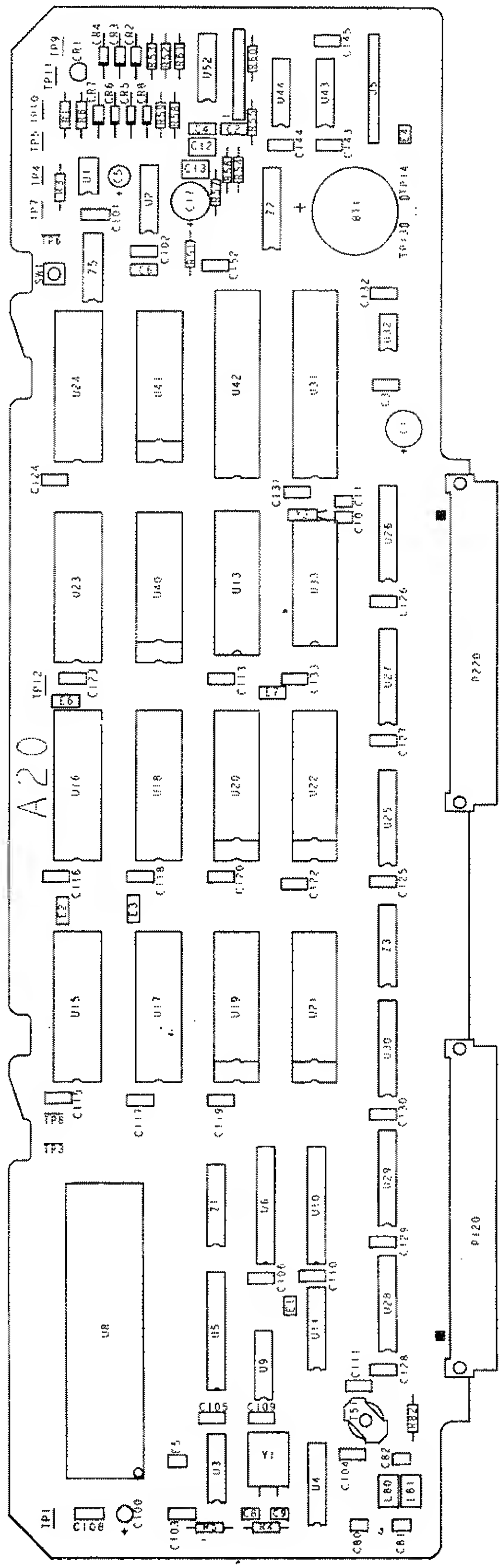

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Figure 6-20. A20 CPU PCA

Table 6-21. A21 Rear Panel I/O PCA

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1, 3, 5	CAP,CER,330PF,+-5%,50V,C0G	697441	04222	SR595A331JAA	3	
C 4, 21, 22, C 24- 28, 40- C 42, 48, 49	CAP,POLYES,0.1UF,+-10%,50V	649913 649913 649913	37942	185-2-104K50AA	13	
C 10, 70	CAP,TA,68UF,+-20%,15V	193615	56289	199D686X0015EA2	2	
C 11, 12	CAP,TA,10UF,+-20%,25V	714774	56289	199D106X0025CG2	2	
C 46, 50	CAP,TA,1UF,+-20%,35V	697417	56289	199D105X0035AG2	2	
J 1	CONN,MICRO-RIBBON,REC,PWB,24 POS	851675	74868	57-20240-23	1	
J 2	CONN,D-SUB,PWB,25 PIN	845214	28198	HDC25M30000-14	1	
J 10	HEADER,1 ROW,.100CTR,4 PIN	631184	00779	640456-4	1	
J 121	HEADER,2 ROW,.100CTR,34 PIN	807446	59730	500-3427ES	1	
MP 1, 2	SPACER,SWAGE,.250 RND,BR,6-32,.220	261727	55566	3045B632B14-MOD.=.220	2	
MP 3, 4	SPACER,SWAGE,.250 RND,BR,4-40,.234	385310	55566	3045B440B14-MOD.=.234	2	
MP 5- 7	SPACER,SWAGE,.250 RND,BR,6-32,.250	446351	55566	3047B632B14	3	
R 1	RES,MF,1K,+-1%,0.125W,100PPM	719468	91637	CMF-55 1001F T-1	1	
R 2	RES,MF,332,+-1%,0.125W,100PPM	192898	91637	CMF-55 3320F T-1	1	
R 8, 9	RES,CF,200,+-5%,0.25W	573055	59124	CF1/4 201J	2	
R 10	RES,CF,620,+-5%,0.25W	641092	59124	CF1/4 621J	1	
R 11	RES,CC,1K,+-10%,1W	109371	01121	GB1021	1	
S 1, 2	SWITCH,SLIDE,SPDT,LOW PROFILE	911250	7Z884	SSSS91(G7857194M)	2	
TP 1- 9	JUMPER,WIRE,NONINSUL,0.200CTR	816090	91984	150T1	9	
U 1	ϟ IC,CMOS,OCTAL BUS TRANSCEIVER	722017	27014	MM74HCT245N	1	
U 2	ϟ IC,NMOS,GPIB ADAPTER	585240	01295	TMS9914ANL	1	
U 3	ϟ IC,LSTTL,OCTAL GPIB XCVR W/OPEN COL	585224	01295	SN75160BN	1	
U 4	ϟ IC,LSTTL,OCTAL IEEE-488 BUS TRANSCVR	686022	01295	SN75162BN	1	
U 5	ϟ IC,CMOS,DUAL CHANNEL UART (DUART)	799494	66419	XLS68C681C	1	
U 6	ϟ IC,TTL,QUAD RS232C LINE DRIVER	414052	04713	MC1488P	1	
U 7	ϟ IC,TTL,QUAD RS232C LINE RECEIVER	524850	01295	SN75189AN	1	
U 8	ϟ IC,CMOS,PROG LOGIC,35NS,5700A-90790	845255	89536	845255	1	
U 18	ϟ IC,COMPARATOR,HI-SPEED,14 PIN DIP	647115	18324	NE522N	1	
VR 3	ϟ ZENER,UNCOMP,4.7V,10%,20.0MA,0.4W	387084	04713	1N750	1	
XU 8	SOCKET,IC,24 PIN	812198	00779	2-641932-3	1	
Z 1, 2	RES,CERM,SIP,10 PIN,9 RES,4.7K,+-2%	484063	91637	CSC10A-01-472G	2	
Z 5	RES,CERM,SIP,6 PIN,5 RES,10K,+-2%	500876	91637	CSC06A-01-103G	1	
NOTES:	ϟ Static sensitive part.					

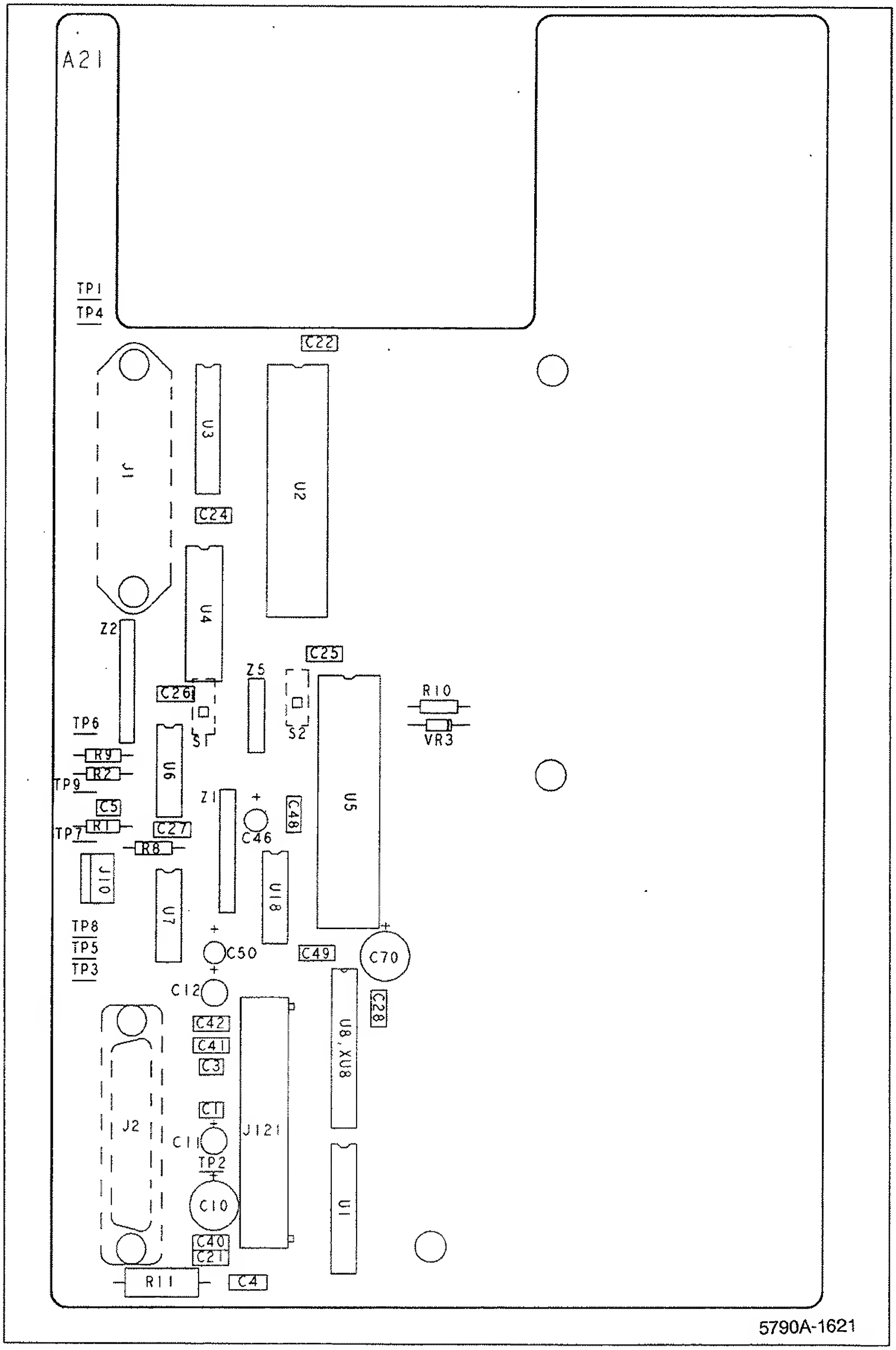

Figure 6-21. A21 Rear Panel I/O PCA

Manufacturers Supply Codes

00779
AMP, Inc.
Harrisburg,PA

01121
Allen-Bradley Co.
Milwaukee, WI

01295
Texas Instruments Inc.
Semiconductor Group
Dallas,TX

02660
Amphenol Corp.
Industrial Technology Div.
Wallingford, CT

02768
ITW (Illinois Tool Works)
Fastex Division
Des Plaines, IL

03296
Nylon Molding Corp.
Monrovia, CA

04222
AVX Corp.
AVX Ceramics Div.
Myrtle Beach, SC

04713
Motorola Inc.
Semiconductor Products Sector
Phoenix, AZ

05347
Ultronix Inc
(Tel Labs)
Grand Junction, CO

06383
Panduit Corp.
Tinley Park, IL

06665
Analog Devices
Formerly Precision Monolithics
Santa Clara, CA

07047
Ross Milton Co., The
Southampton, PA

07263
Fairchild Semiconductor
North American Sales
Cupertino, CA

08718
ITT Cannon Electric
Phoenix Div.
Phoenix, AZ

09214
General Electric Co.
Semiconductor Products Dept.
Auburn, NY

0AKZ5
Crane Electronics
Cincinnati, Ohio

0BW21
Noritake Co. Inc.
Burlington, MA

0CLN7
Emhart Fastening Group
Shelton, CT

0LUA3
Philips Components
Slatersville, RI

10389
ITW Switches
Div. of Illinois Tool Works Inc.
Chicago, IL

12581
Hitachi Metals Inernational Ltd.
Div. of Hitachi Magna-Lock
Big Rapids, MI

13103
Thermalloy Co., Inc.
Dallas, TX

13919
Burr-Brown Corp.
Tucson, AZ

14552
Microsemi Corp.
(Formerly Micro-Semiconductor)
Santa Ana, CA

14936
General Instrument Corp.
Power Semiconductor Div.
Hicksville, NY

15238
ITT Semiconductors
A Div. of International Telephone &
Telegraph Corp.
Lawrence, MA

17856
Siliconix Inc.
Santa Clara, CA

18310
Concord Electronics Corp.
New York, NY

18324
Signetics Corp.
Military Products Div.
Orem, UT

20584
Enochs Inc.
Indianapolis, IN

21845
Solitron Devices Inc.
Corp Hq & Semiconductor Mfg. Group
Riviera Beach, FL

21958
Hughes(RS)Co. Inc.
Los Angeles, CA

22670
GM Nameplate, Inc.
Seattle, WA

23172
Alpha Wire Corp.
Torrance, CA

24355
Analog Devices Inc.
Norwood, MA

24759
Lenox-Fugle Electronics Inc.
South Plainfield, NJ

25088
Siemens Corp.
Iselin, NJ

26805
M/A-COM Omni Spectra Inc.
Microwave Connector Div.
Sub of M/A-Com Inc.
Waltham, MA
Formerly Omni Spectra

26806
American Zettler Inc.
Aliso Viejo, CA

27014
National Semiconductor Corp.
Santa Clara, CA

27264
Molex Inc.
Lisle, IL

28213
Minnesota Mining & Mfg. Co.
Consumer Specialties Div. 3M Center
Saint Paul, MN

28480
Hewlett-Packard Co.
Corporate HQ
Palo Alto, CA

2M530
John Perine
Seattle, WA

30161
Aavid Engineering Inc.
Laconia, NH

31918
ITT/Schadow Inc.
Eden Prairie, MN

32559
Bivar, Inc.
Irvine, CA

33297
NEC Electronics USA Inc.
Electronic Arrays Inc. Div.
Mountain View, CA

34335
Advanced Micro Devices (AMD)
Sunnyvale, CA

34371
Harris Corp.
Semiconductor Sector
Melbourne, FL

37942
North American Capacitor Co.
Mallory Div.
Greencastle, IN

39003
Maxim Industries
Middleboro, MA

3X073
Anodizing Inc.
Portland, OR

Manufacturers Supply Codes (cont)

40551
Milford Rivet & Machine Co.
Milford, CT

46384
Penn Engineering & Mfg. Corp.
Danboro, PA

51406
Murata Erie, No. America Inc.
Symrna, GA

54583
TDK Electronics Corp.
Port Washington, NY

55285
Bercquist Co. Inc., The
Minneapolis, MN

55322
Samtec Inc.
New Albany, IN

55566
RAF Electronic Hardware Inc.
Seymour, CT

55637
Valco Instruments
Houston, TX

55801
Compensated Devices, Inc.
Melrose, MA

56289
Sprague Electric Co.
Nashua, NH

56878
SPS Technologes Inc.
Aerospace & Industrial Products Div.
Jenkintown, PA

59124
KOA Speer Electronics Inc.
Bradford, PA

59640
Supertex Inc.
Sunnyvale, CA

59730
Thomas and Betts Corp.
Iowa City, IA

60705
Cera-Mite Corp.
Grafton, WI

61177
Davidson Plastics
Kent, WA
Formerly Davidson Products

61429
Fox Electronics
Fort Myers, FL

61529
Aromat Corp.
New Providence, NJ

61935
Schurter Inc.
Petaluma, CA

61964
Omron Electronics Inc.
Schaumsburg, IL

62643
United Chemi-con Inc.
Rosemont, IL

62786
Hitachi America Ltd.
Semiconductor & IC Div.
San Jose, CA

64155
Linear Technology
Milpitas, CA

64537
KDI Electronics Inc.
Sub of KDI Corp.
Whippany, NJ

64762
Elantec Inc.
Milipitas, CA

65940
Rohm Corp
Irvine, CA

66182
Sprague Interfet
Garland, TX

68919
Inter-Technical Group Inc., The
Irvington, NY

70903
Cooper Belden Electronic Wire & Cable
Geneva, IL

71400
Bussman
Div. of Cooper Industries Inc.
St. Louis, MO

72259
Nytronics Inc.
New York, NY

73445
Amperex Electronic Corp.
Hicksville, NY

73734
Federal Screw Products Inc.
Chicago, IL

74594
Component Resources Inc.
Div of EPI International Corp.
Beaverton, OR

78189
Illinois Tool Works Inc.
Shakeproof Div.
Elgin, IL

79963
Zierick Mfg. Corp.
Mount Kisco, NY

80294
Bourns Instruments Inc.
Riverside, CA

81349
Military Specifications

84411
American Shizuki Corp.
Ogallala Opns
Ogallala, NE

86928
Seastrom Mfg. Co. Inc.
Glendale, CA

89536
John Fluke Mfg. Co., Inc.
Everett, WA

8A233
Philips ECG Inc.
Div. of North American Philips Corp.
Williamsport, PA

91506
Augat, Inc.
Attleboro, MA

91637
Dale Electronics Inc.
Columbus, NE

91984
Maida Development Co.
Hampton, VA

93108
Lucas Duralith Corp.
Millville, NJ

95354
Methode Mfg. Corp.
Rolling Meadows, IL

Section 7
Schematic Diagrams

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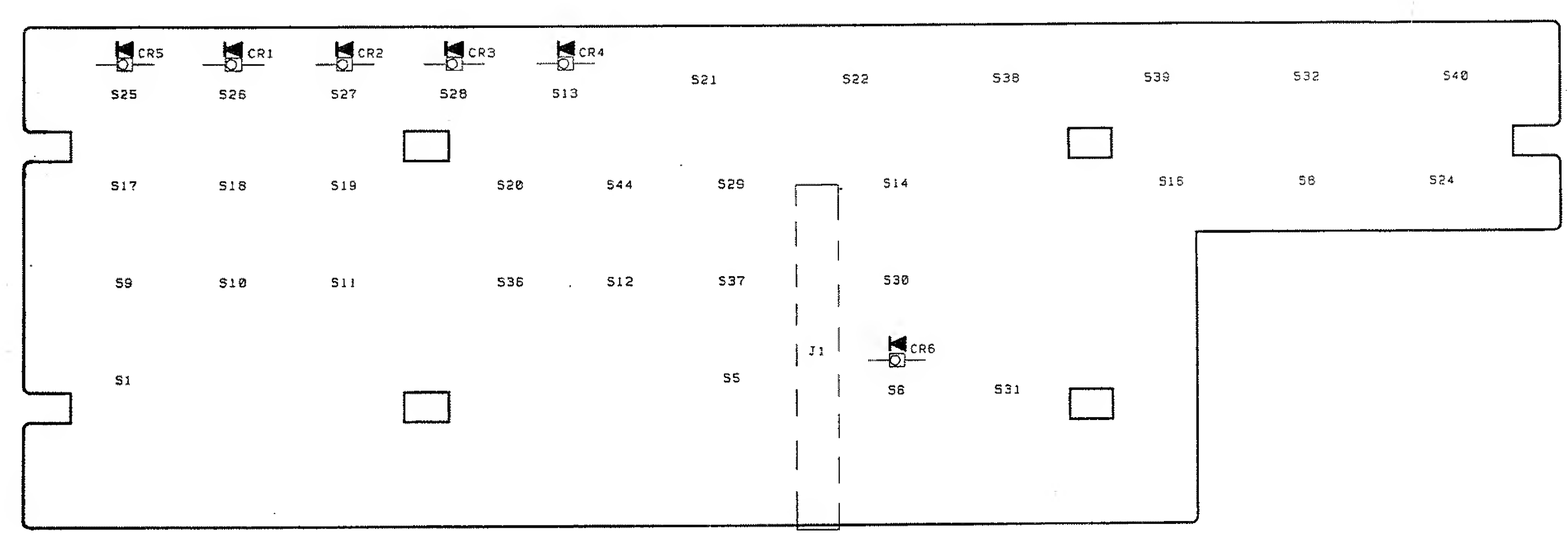


Figure 7-1. A1 Keyboard

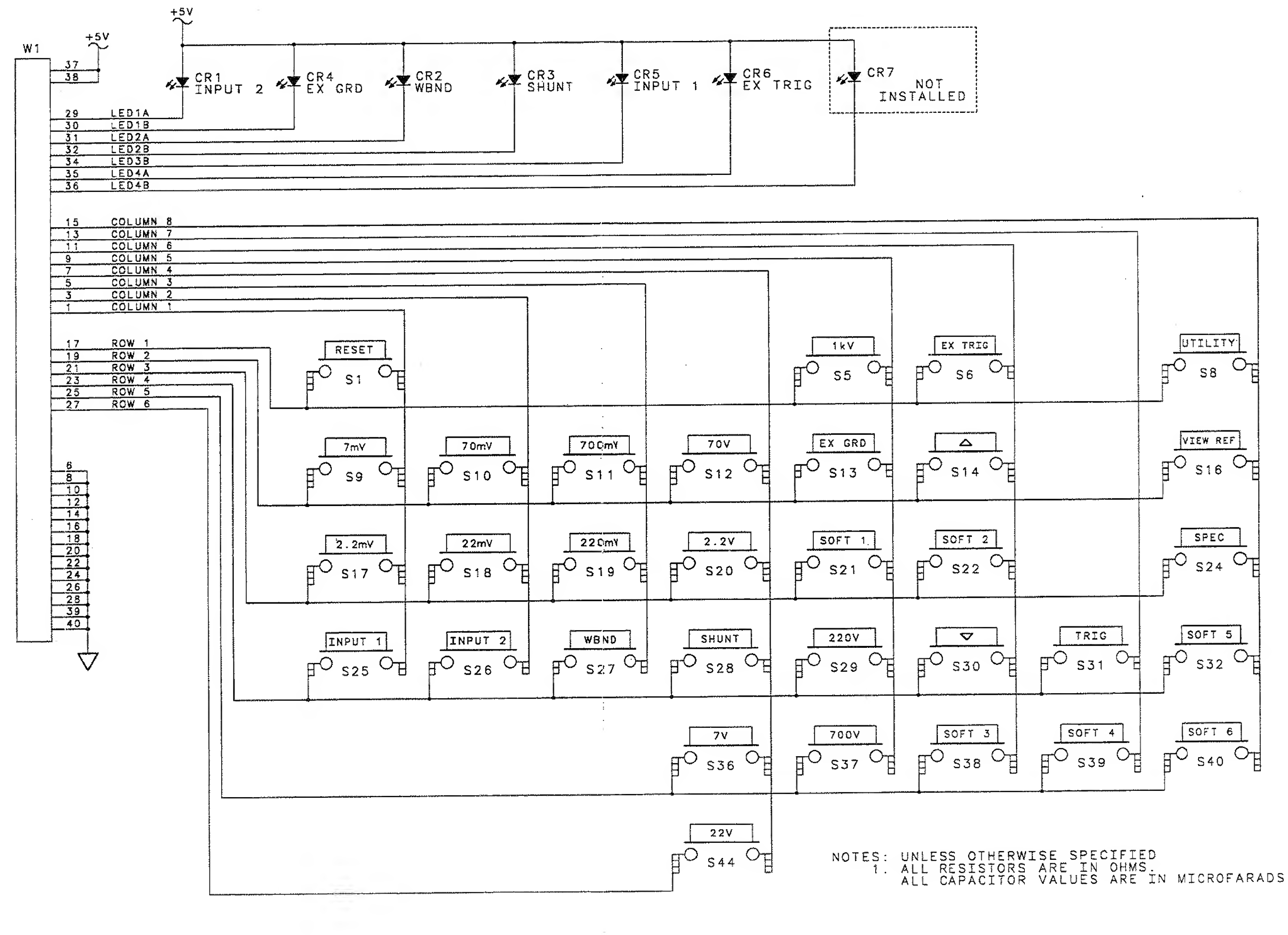
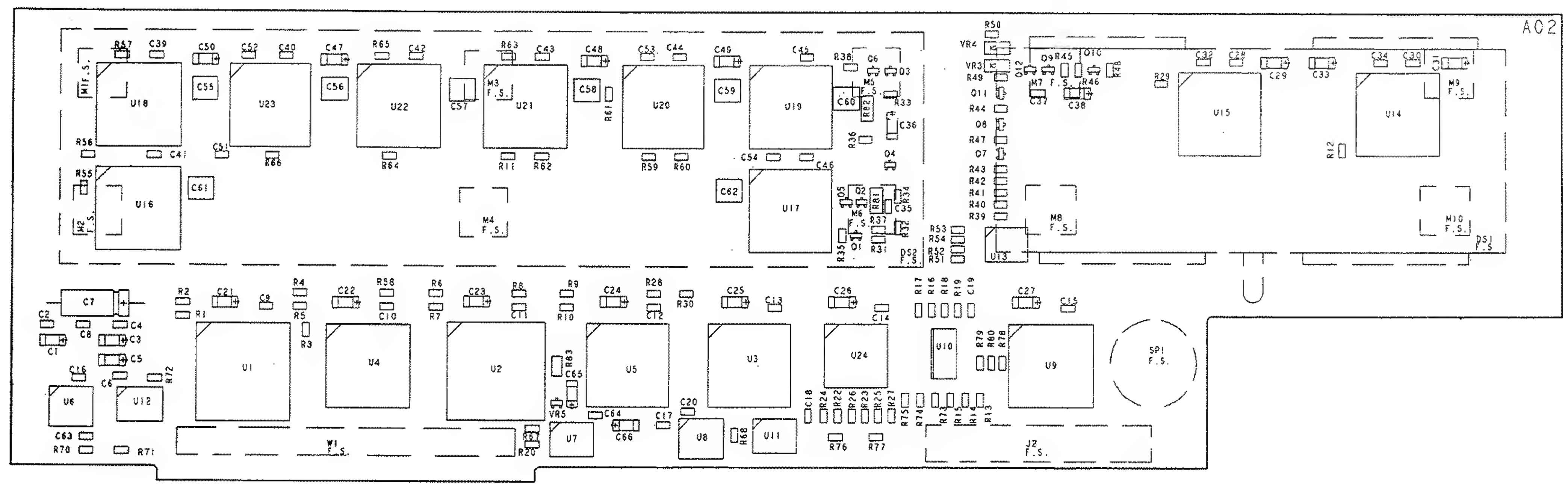


Figure 7-1. A1 Keyboard (cont)



5790A-1602

Figure 7-2. A2 Front Panel PCA

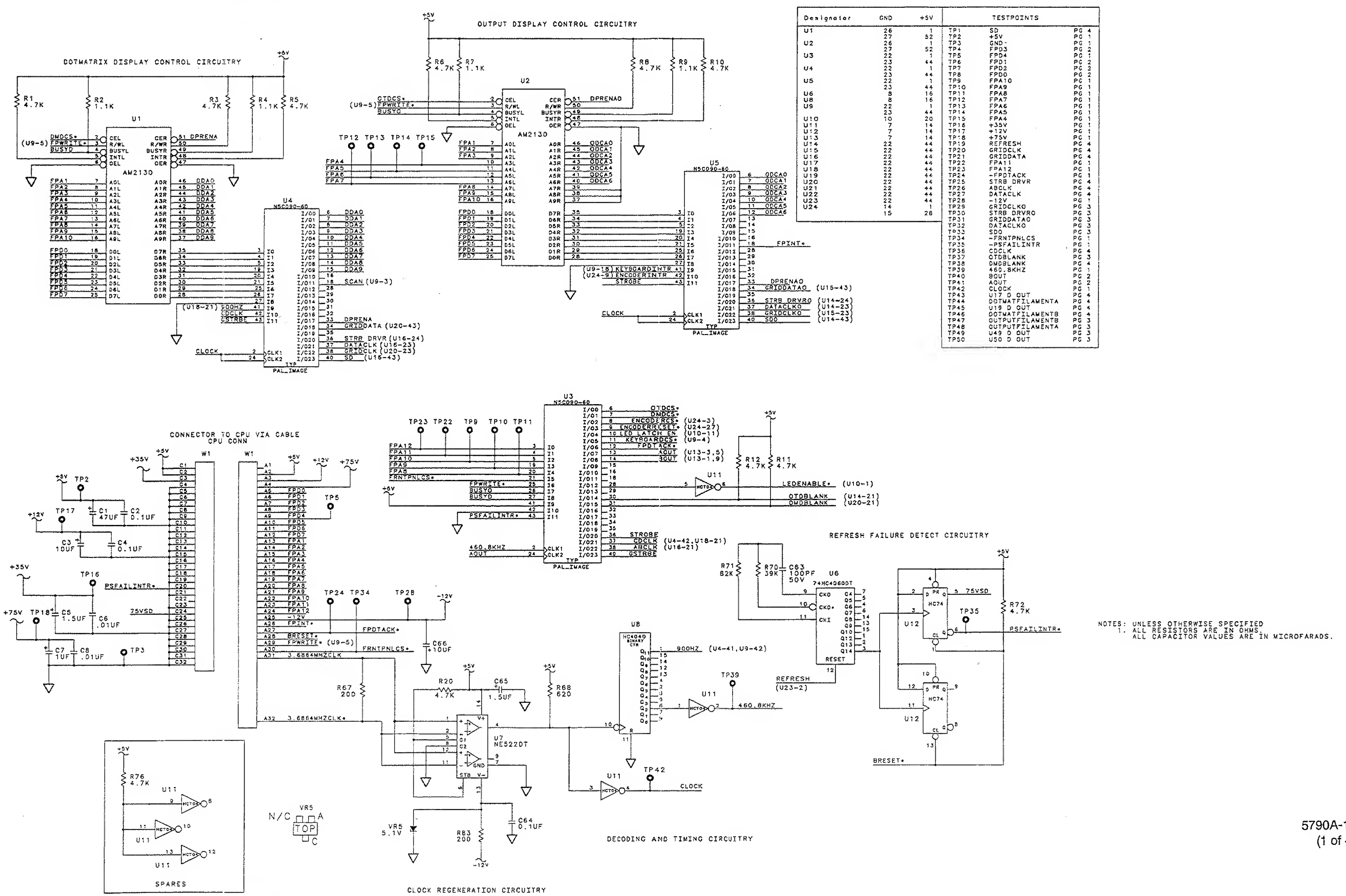


Figure 7-2. A2 Front Panel PCA (cont)

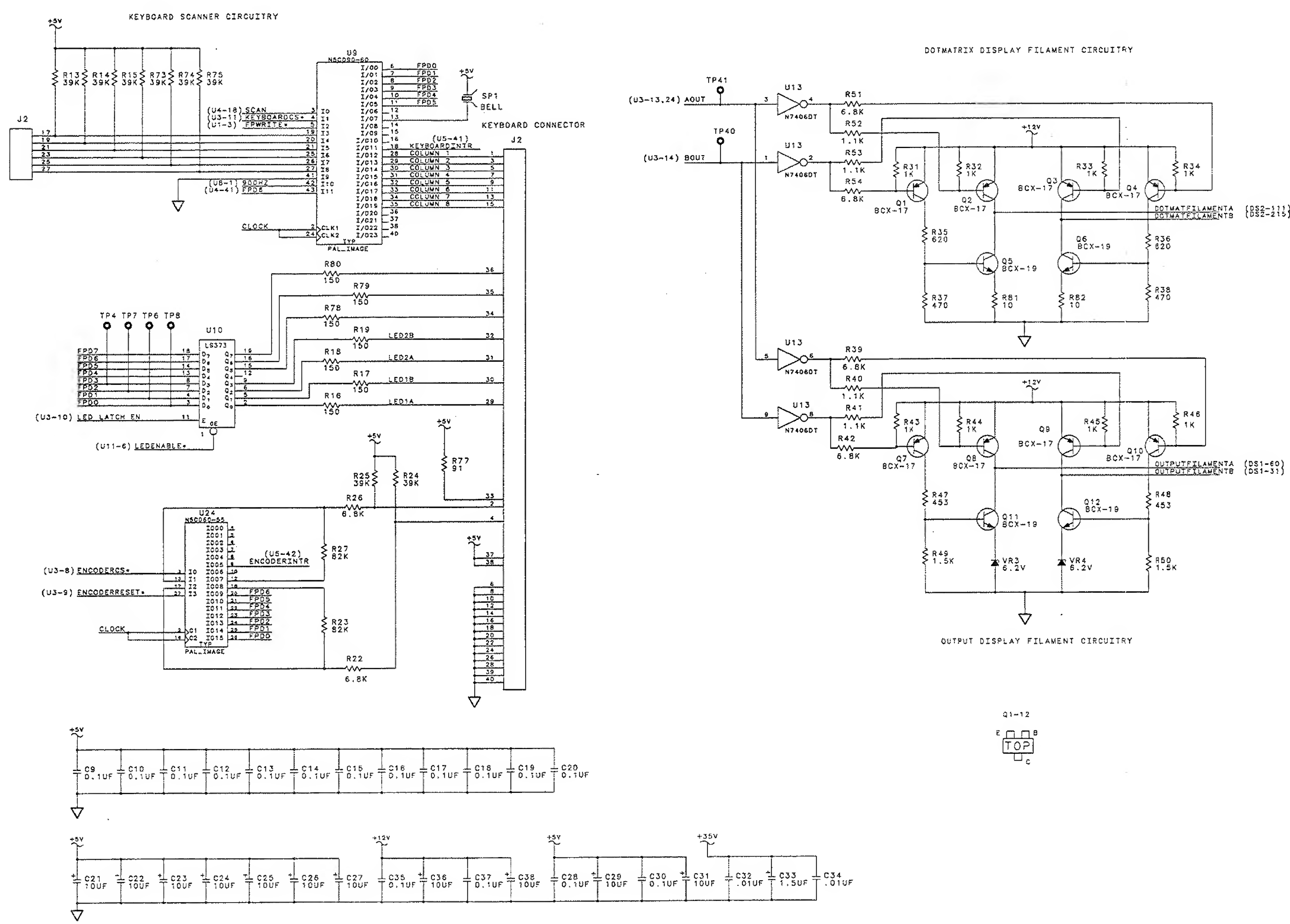


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Figure 7-2. A2 Front Panel PCA (cont)

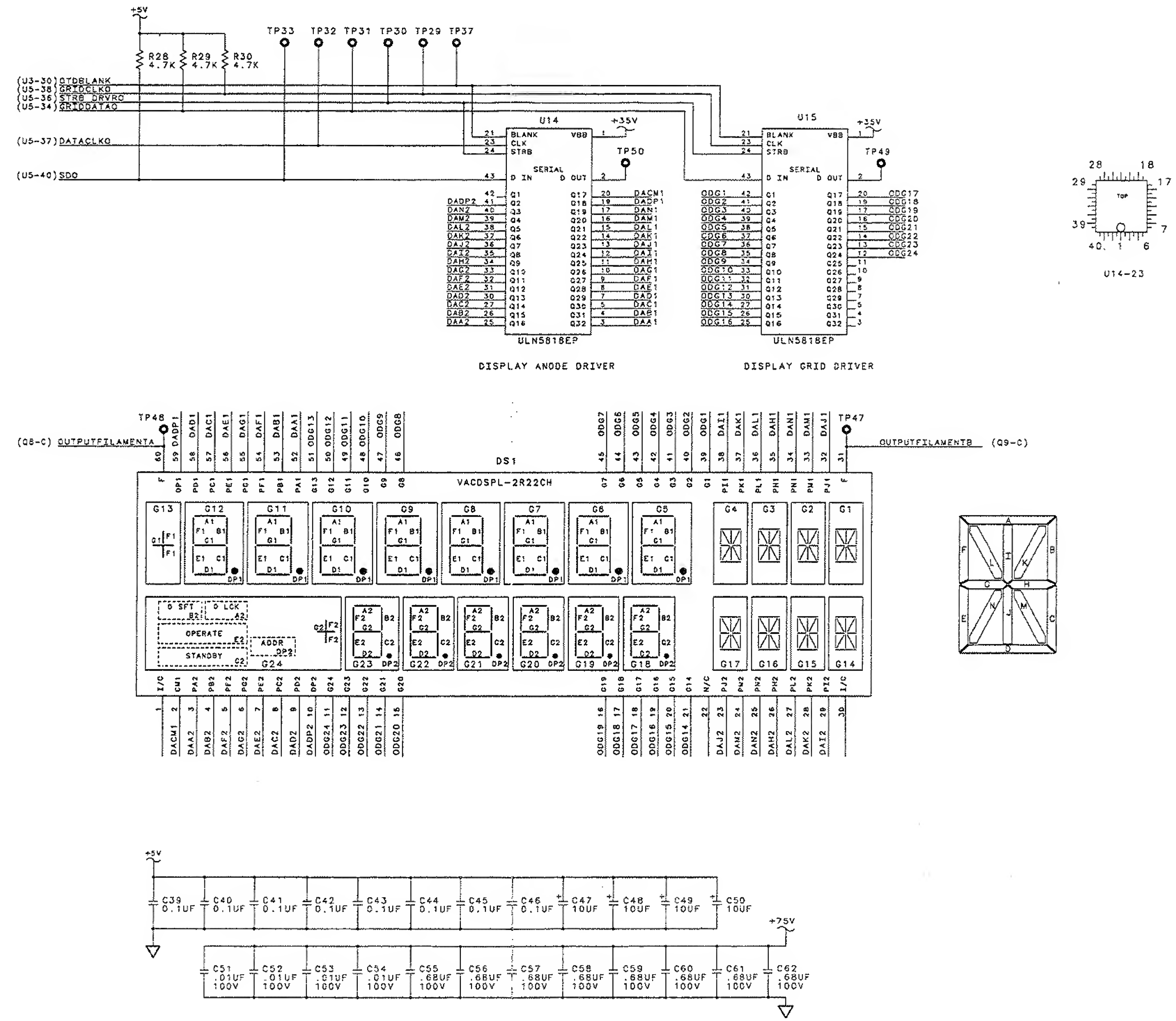

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Figure 7-2. A2 Front Panel PCA (cont)

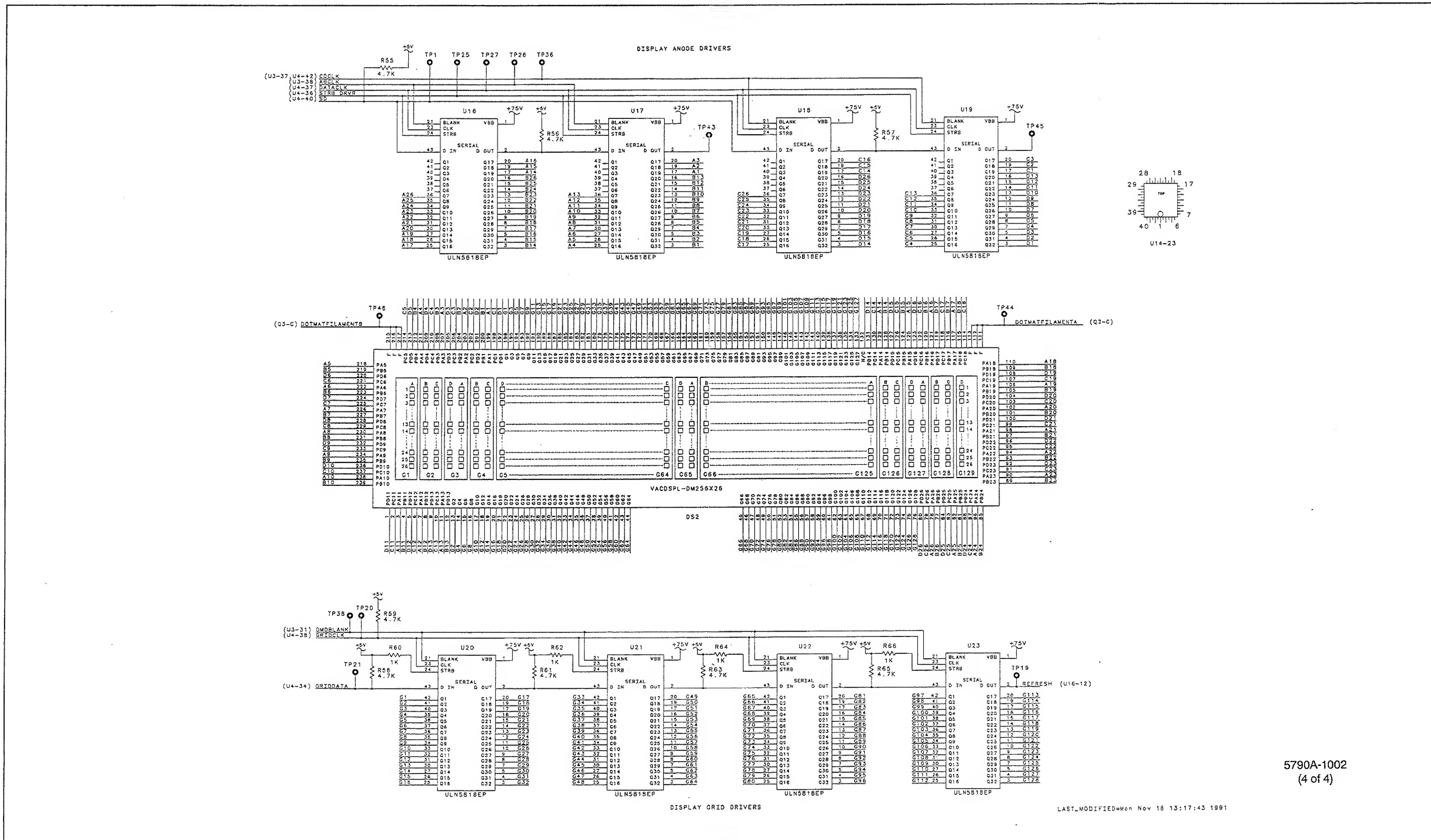
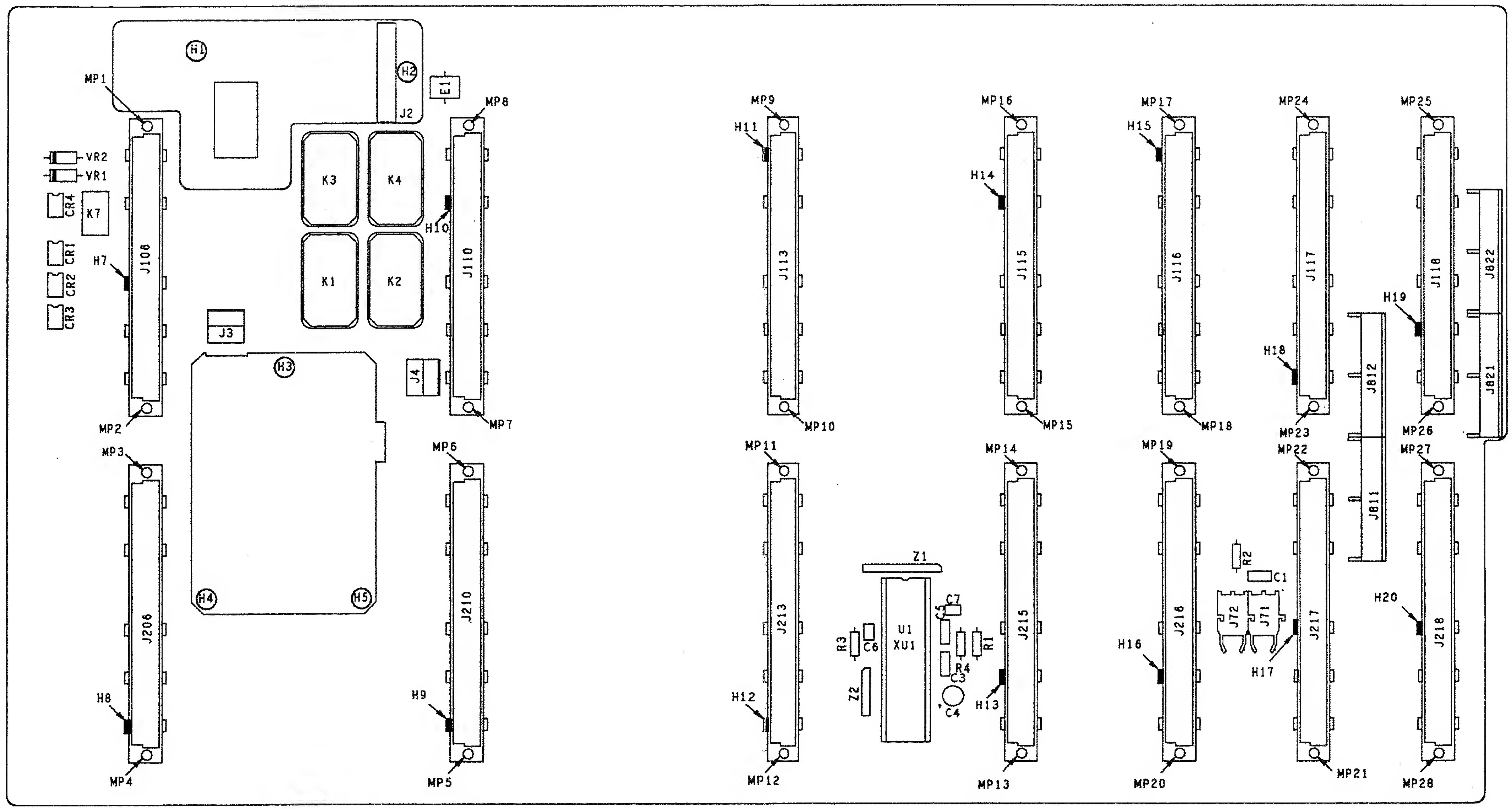


Figure 7-2. A2 Front Panel PCA (cont)



5790A-1603

Figure 7-3. A3 Analog Motherboard PCA

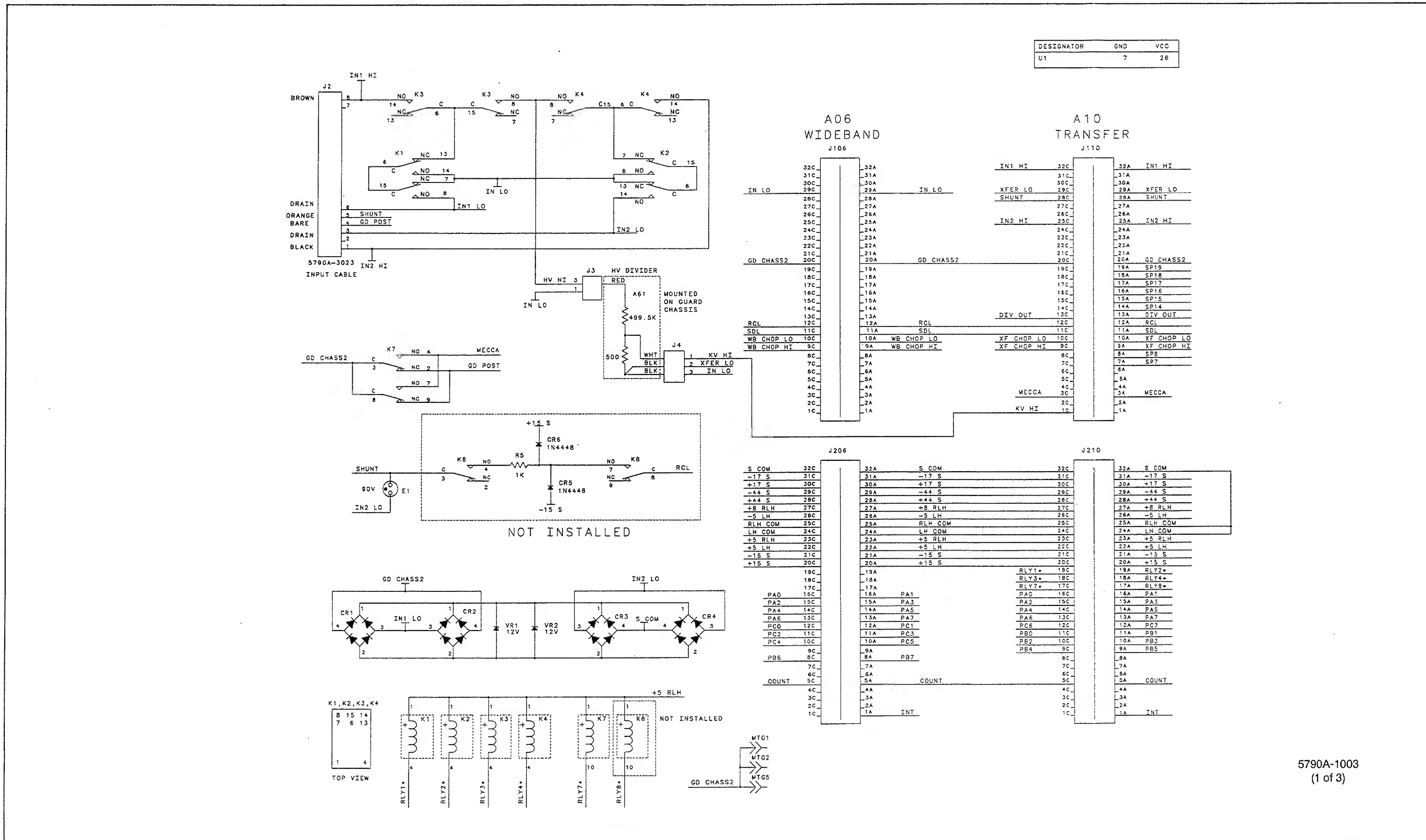


Figure 7-3. A3 Analog Motherboard PCA (cont)

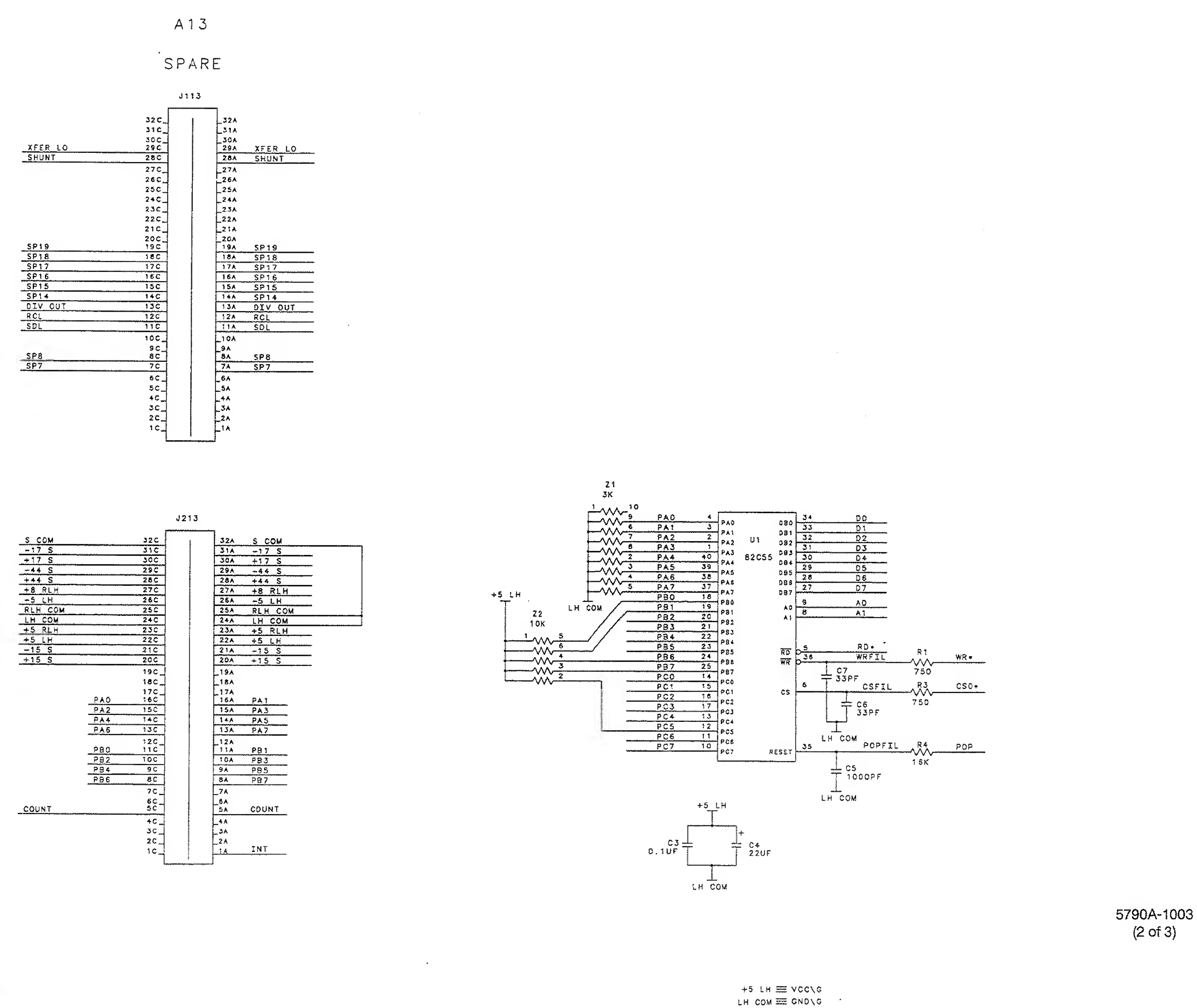


Figure 7-3. A3 Analog Motherboard PCA (cont)

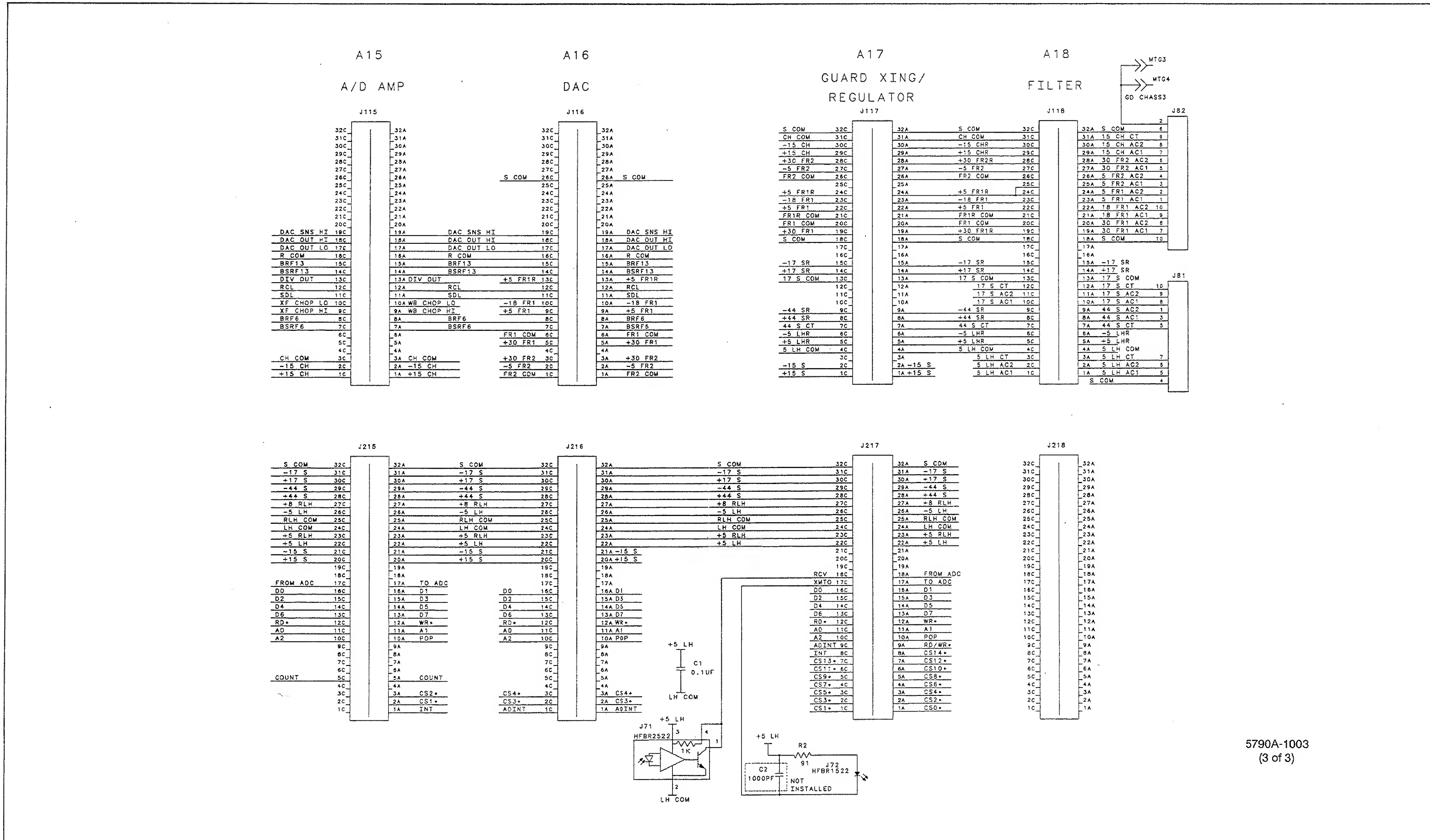


Figure 7-3. A3 Analog Motherboard PCA (cont)

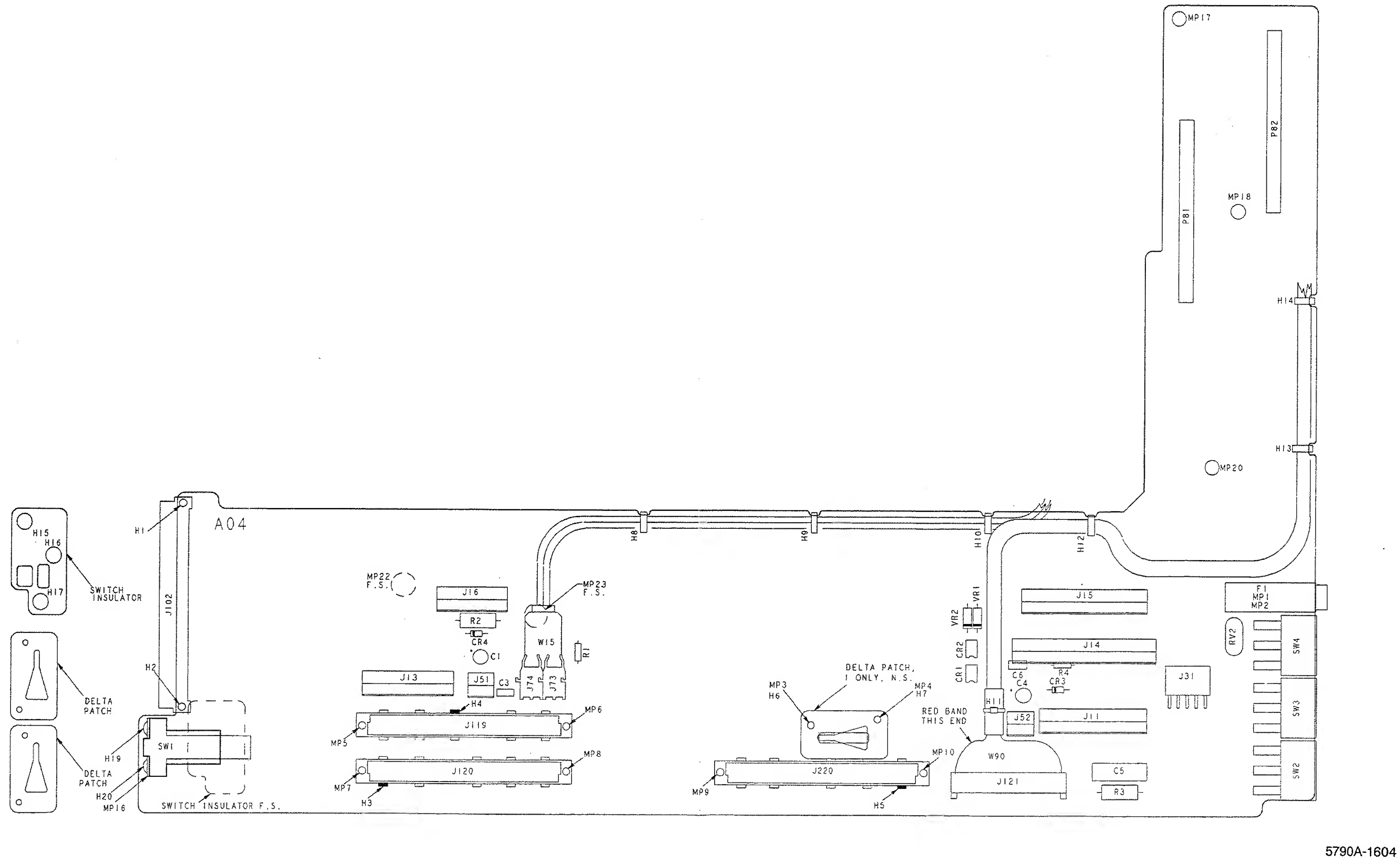


Figure 7-4. A4 Digital Motherboard PCA

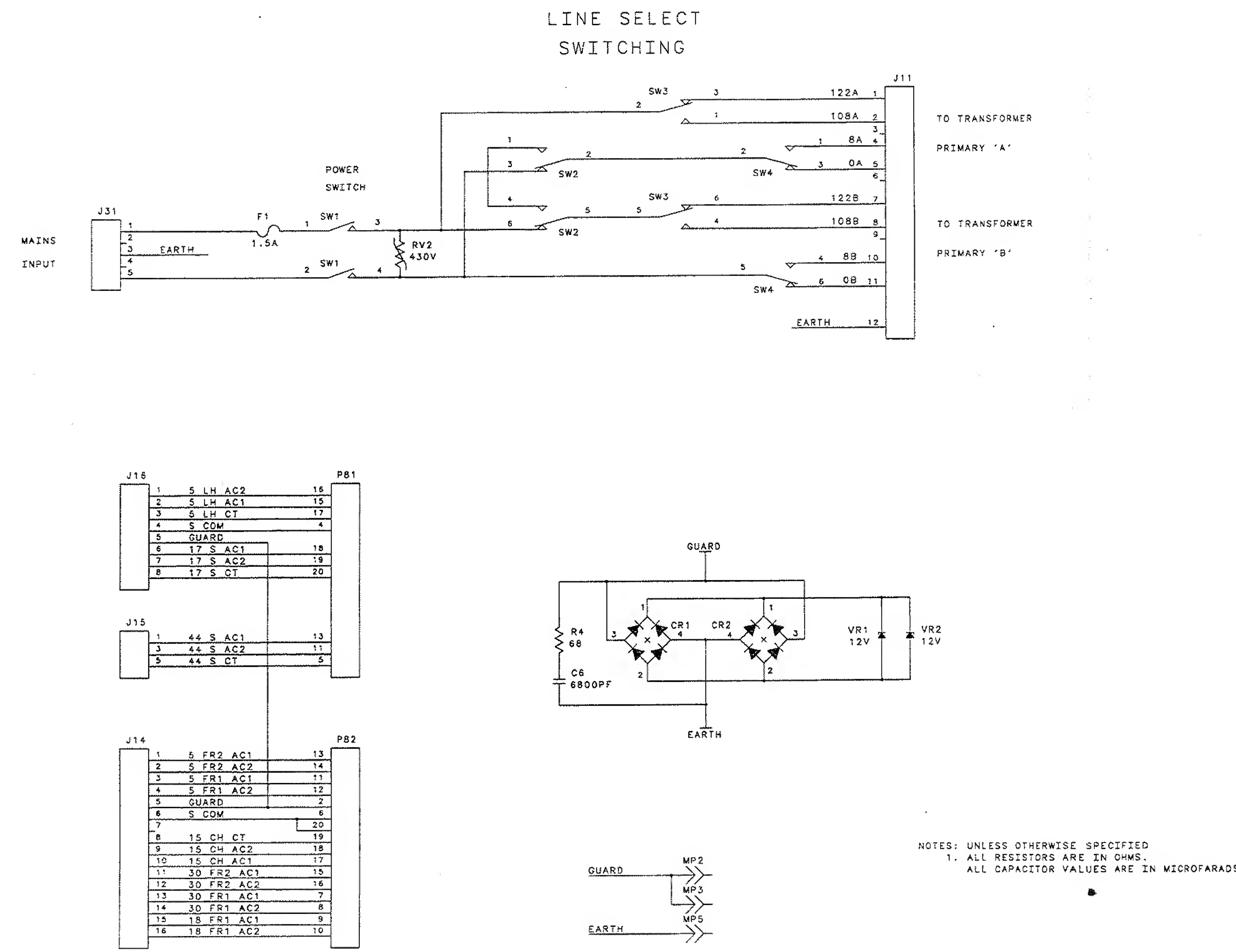


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Figure 7-4. A4 Digital Motherboard PCA (cont)

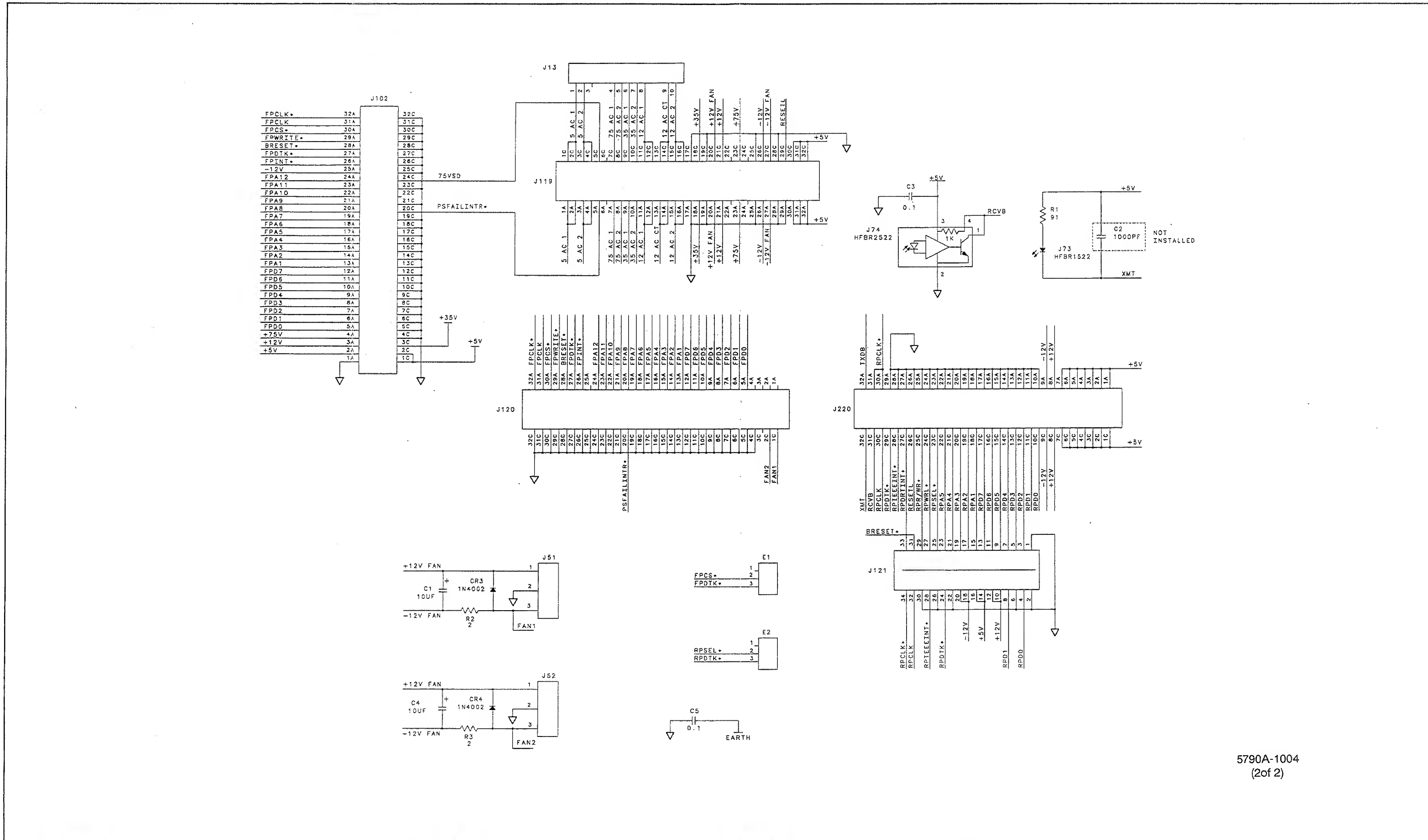

Figure 7-4. A4 Digital Motherboard PCA (cont)

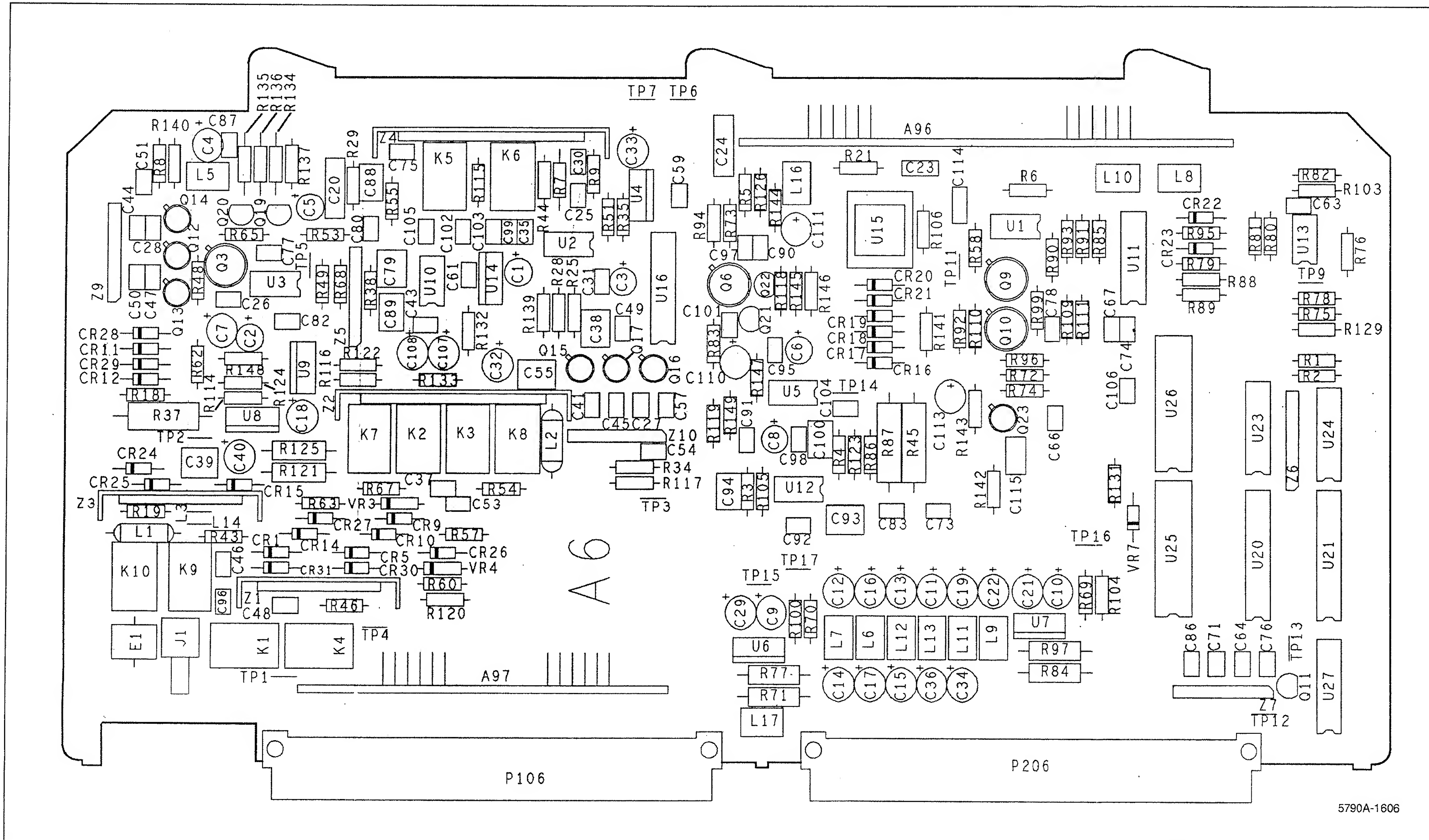

Figure 7-5. A6 Wideband PCA (Option -03)

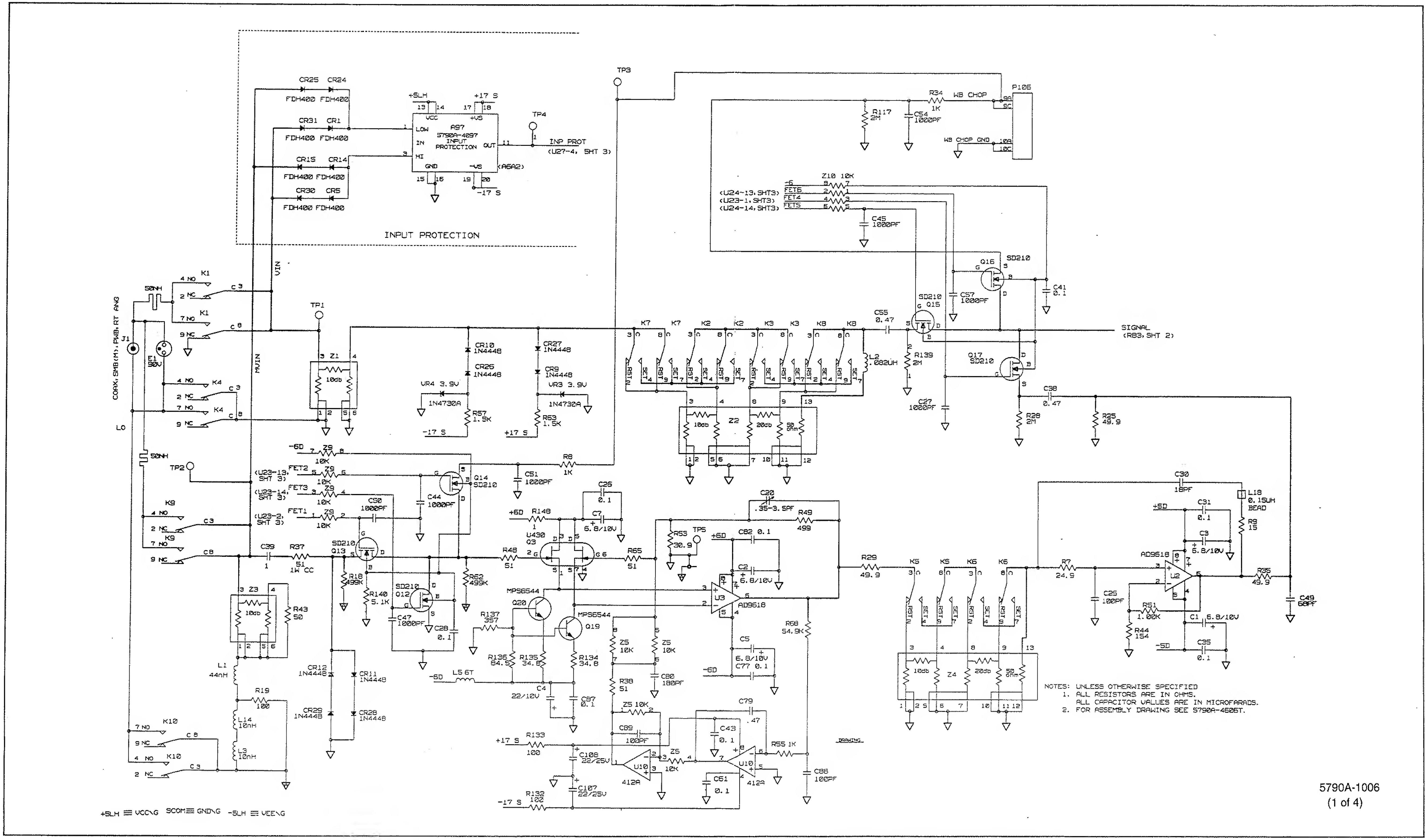

Figure 7-5. A6 Wideband PCA (Option -03) (cont)

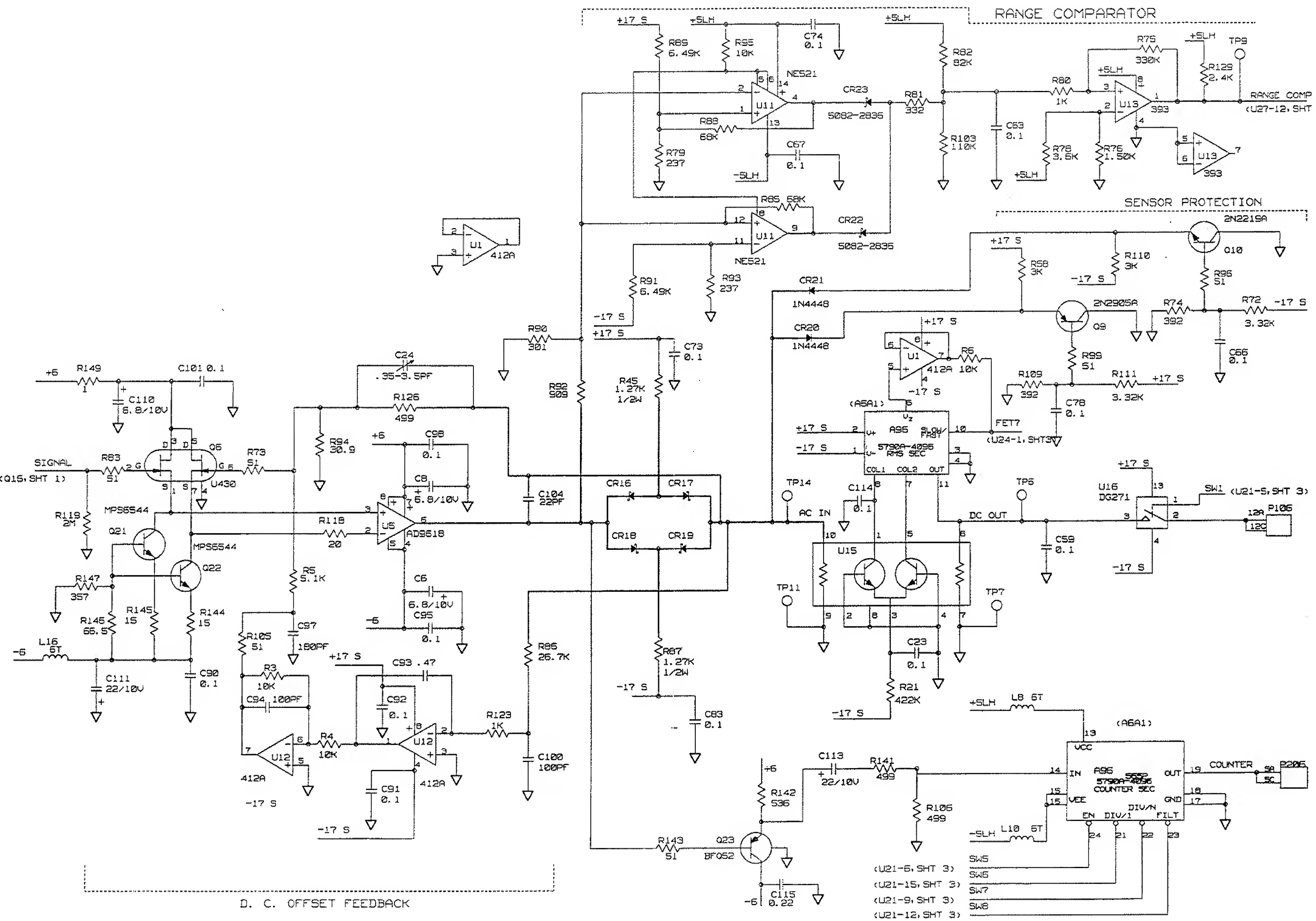

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Figure 7-5. A6 Wideband PCA (Option -03) (cont)

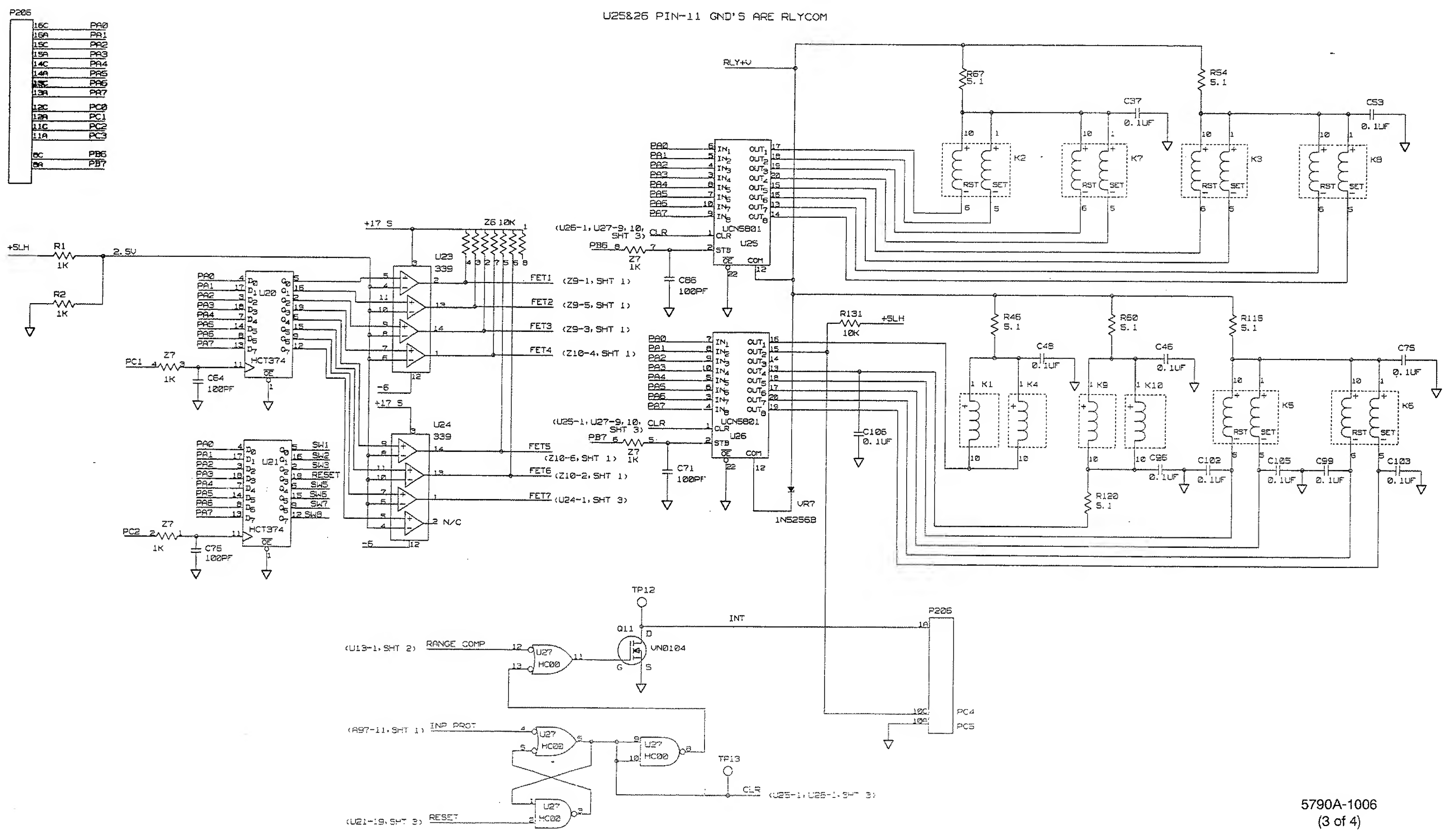
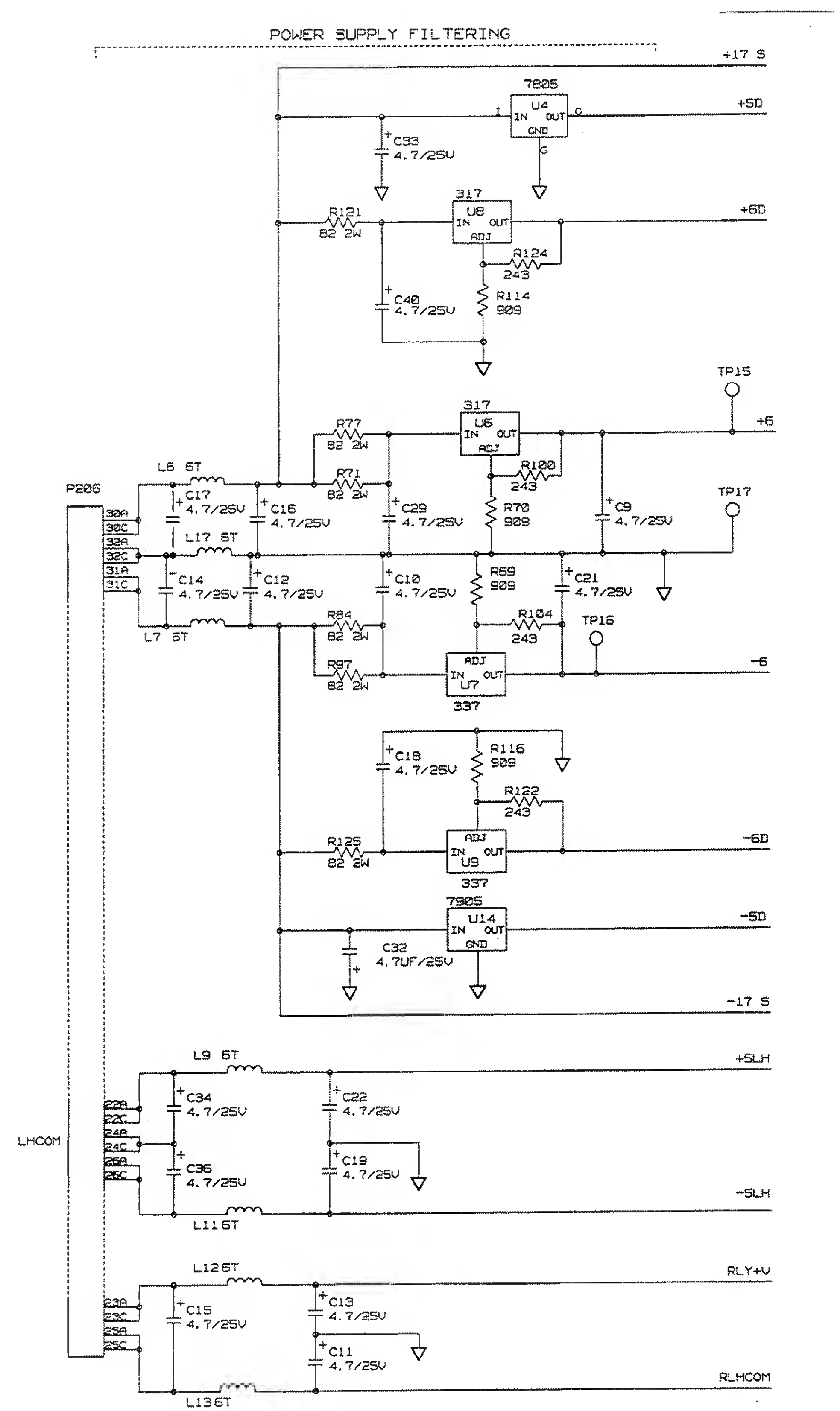


Figure 7-5. A6 Wideband PCA (Option -03) (cont)



TESTPOINTS		
TP1	VIN	PG 1
TP2	MVIN	PG 1
TP3	WB CHOP	PG 1
TP4	INP PROT	PG 1
TP5	GND	PG 1
TP6	DC OUT	PG 2
TP7	GND	PG 2
TP9	RANGE COMP	PG 2
TP11	GND	PG 2
TP12	INT	PG 3
TP13	CLR	PG 3
TP14	AC IN	PG 2
TP15	+6	PG 4
TP16	-6	PG 4
TP17	GND	PG 4

POWER PINS TABLE

REF DES	+SLH	-SLH	SCOM	RLHCOM
U11	14	13	7	
U13	8	—	4	
U16	—	—	5	
U20	20	—	1.10	
U21	20	—	1.10	
U25	21	—	22	11
U26	21	—	22	11
U27	14	—	7	

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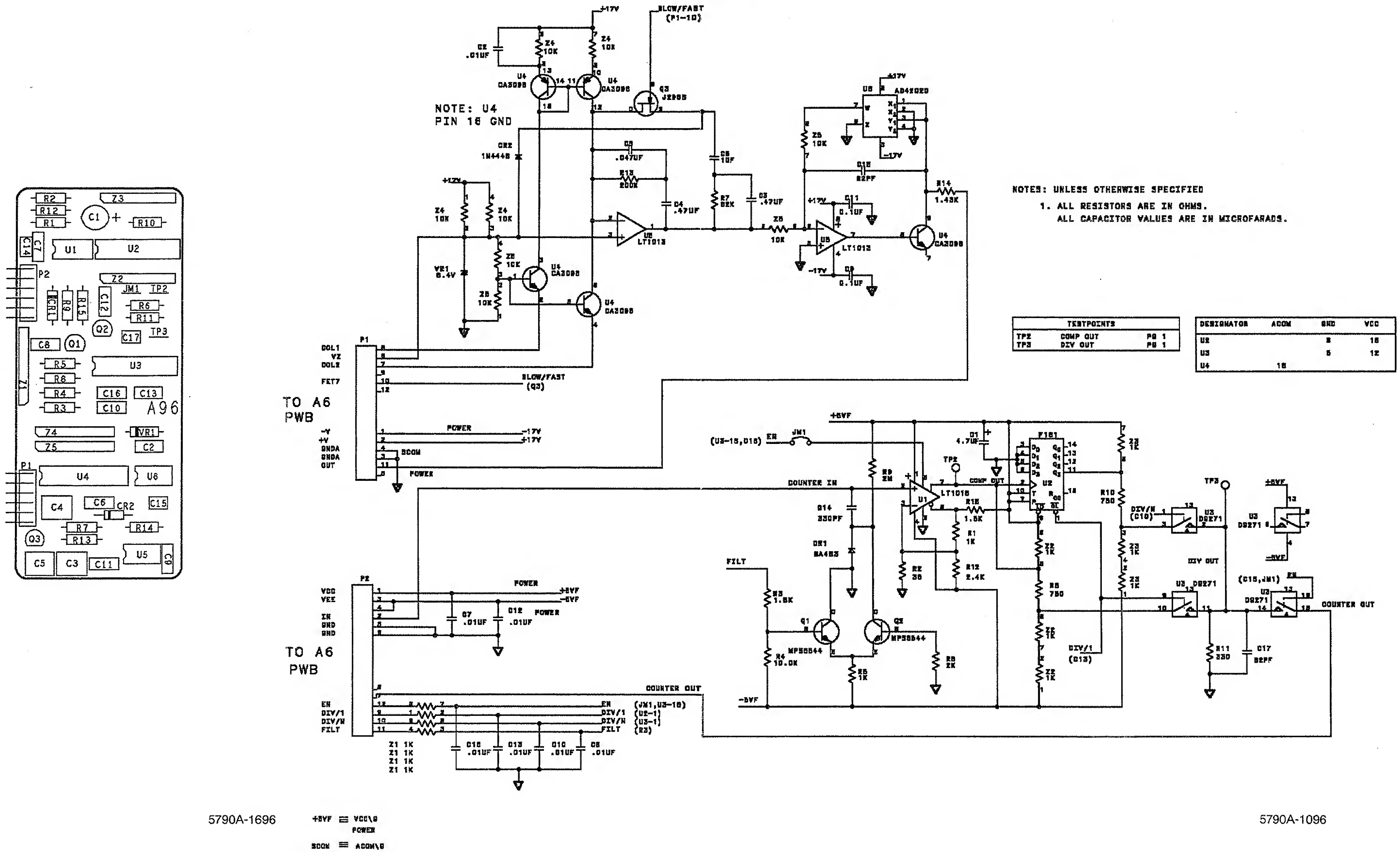
Figure 7-5. A6 Wideband PCA (Option -03) (cont)

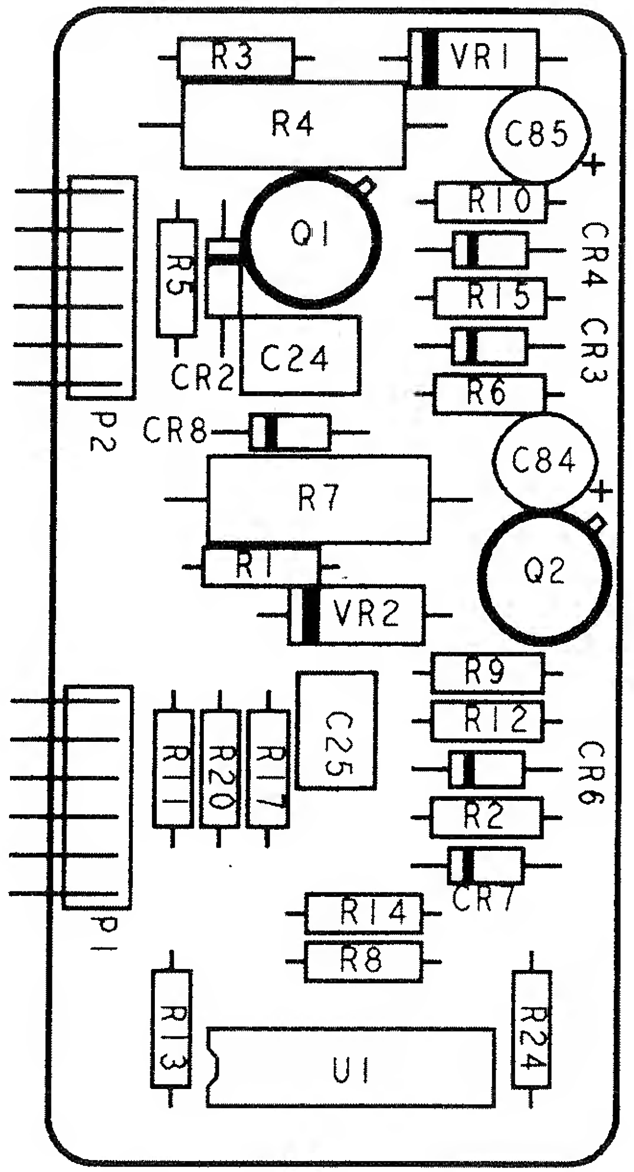


NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

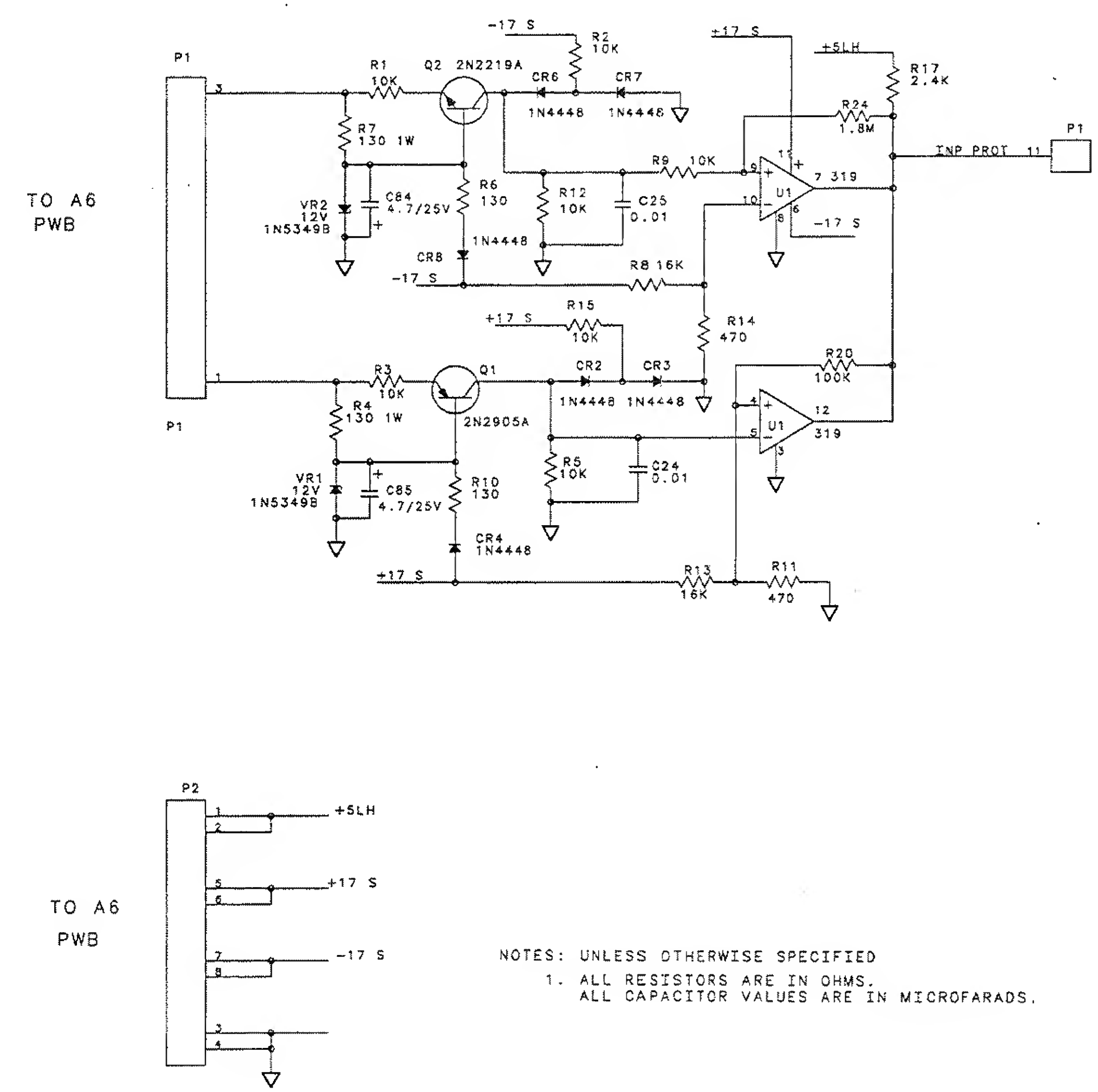
TESTPOINTS		
TP2	COMP OUT	PG 1
TP3	DIV OUT	PG 1

DESIGNATOR	ACOM	GND	VCC
U2		8	16
U3		5	12
U4	16		

Figure 7-6. A6A1 RMS Support PCA



5790A-1697



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

5790A-1097

Figure 7-7. A6A2 WB Input Protection PCA

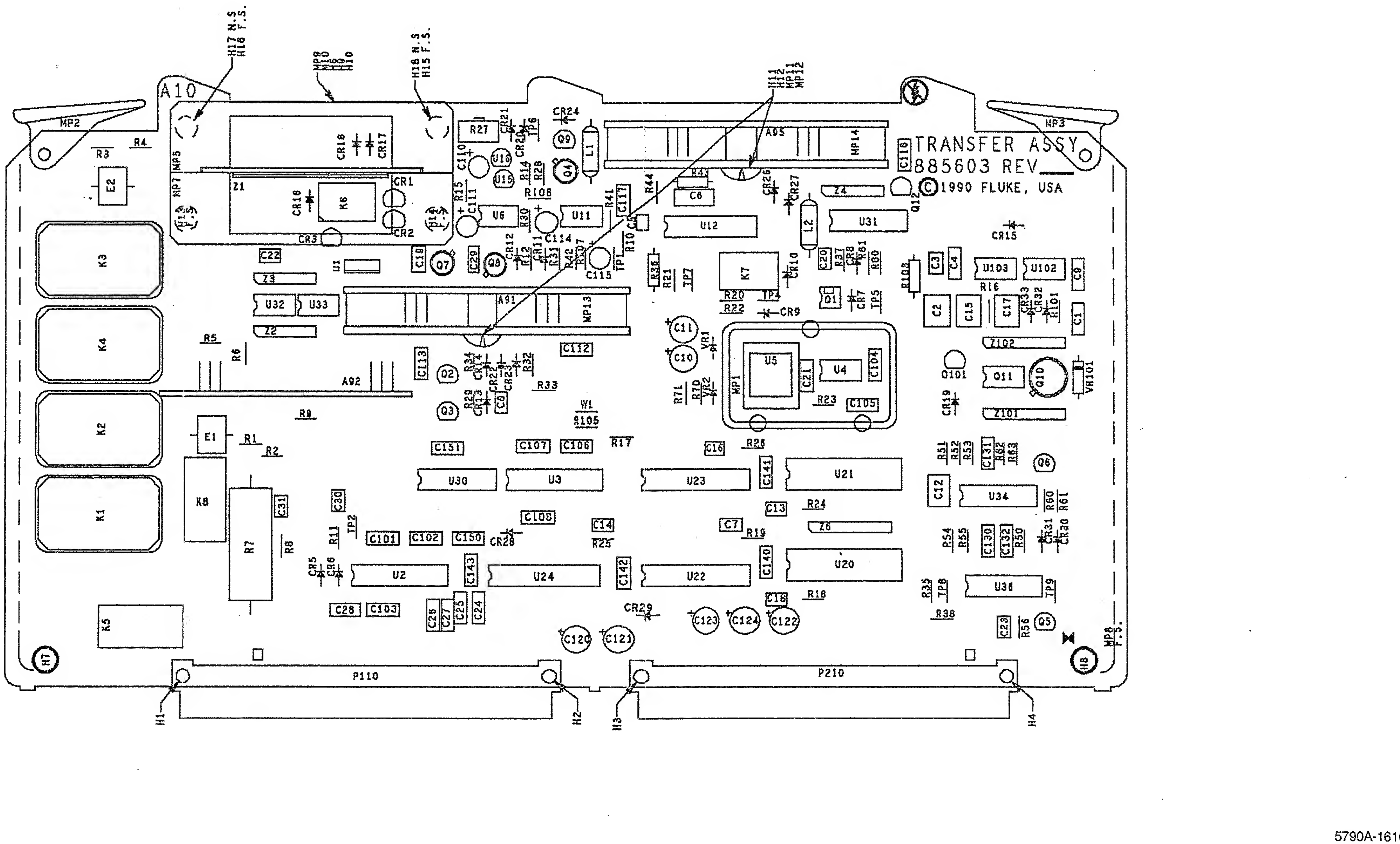
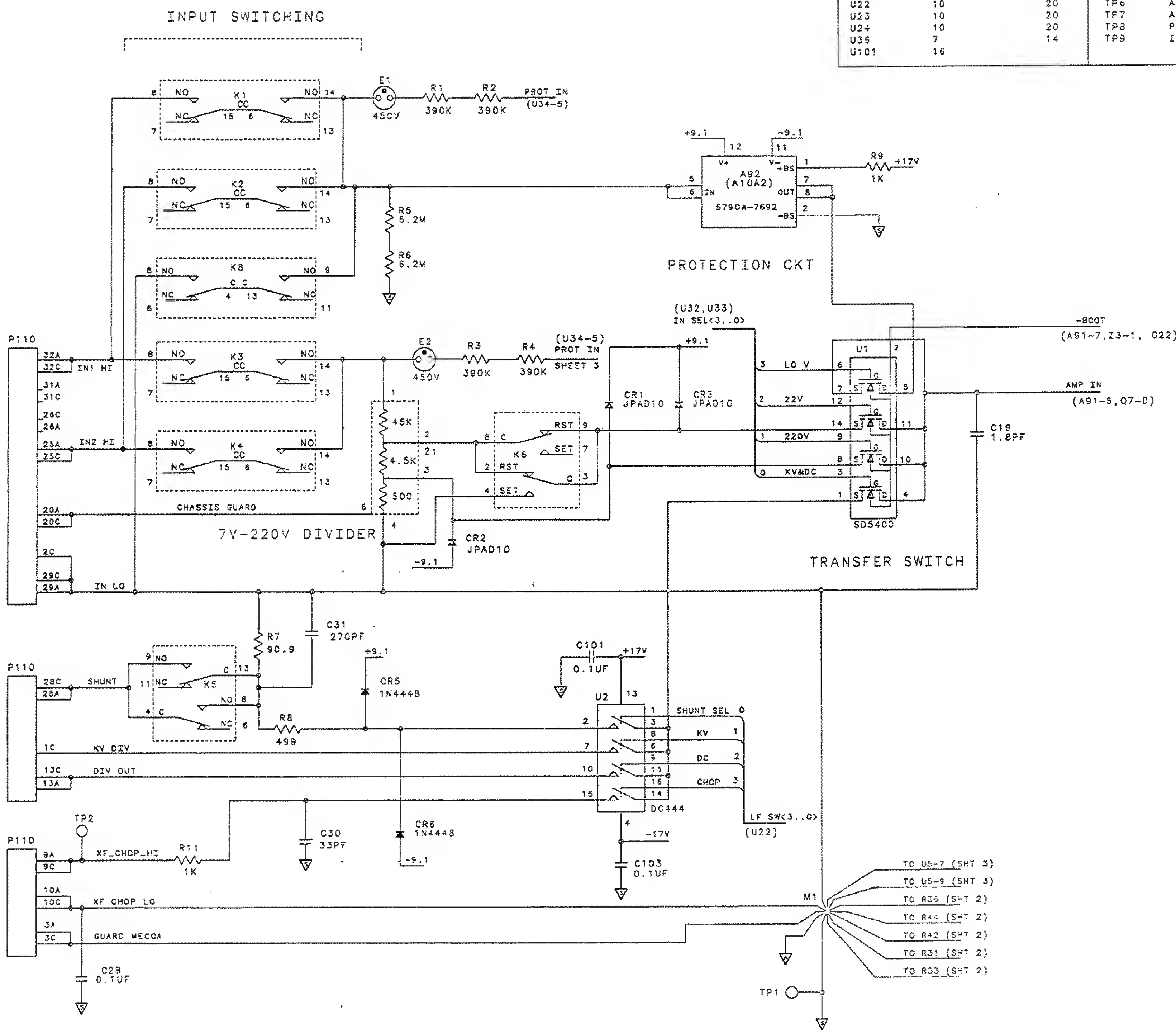


Figure 7-8. A10 Transfer PCA

DESIGNATOR	GND	RLHCOM	VCC
U2	5		12
U3	5		12
U20		11	21
U21		11	21
U22	10		20
U23	10		20
U24	10		20
U36	7		14
U101	16		

TESTPOINTS		
TP1	SCOM	PG 1
TP2	XF CHOP HI	PG 1
TP4	AMP OUT	PG 3
TP5	OUT	PG 3
TP6	A3 OUT	PG 2
TP7	A4 IN	PG 2
TP8	PC6	PG 4
TP9	INT	PG 4



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

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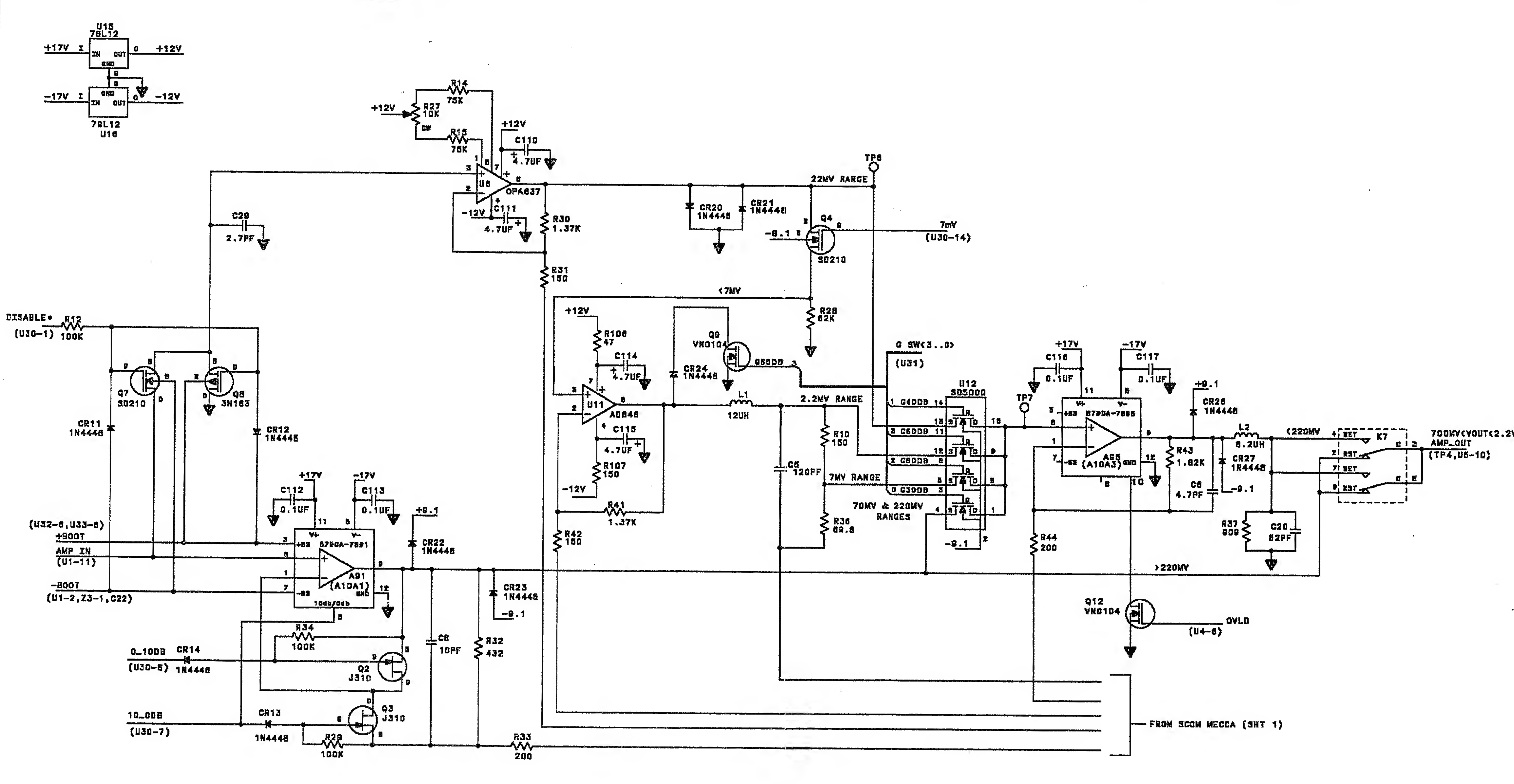
Figure 7-8. A10 Transfer PCA (cont)



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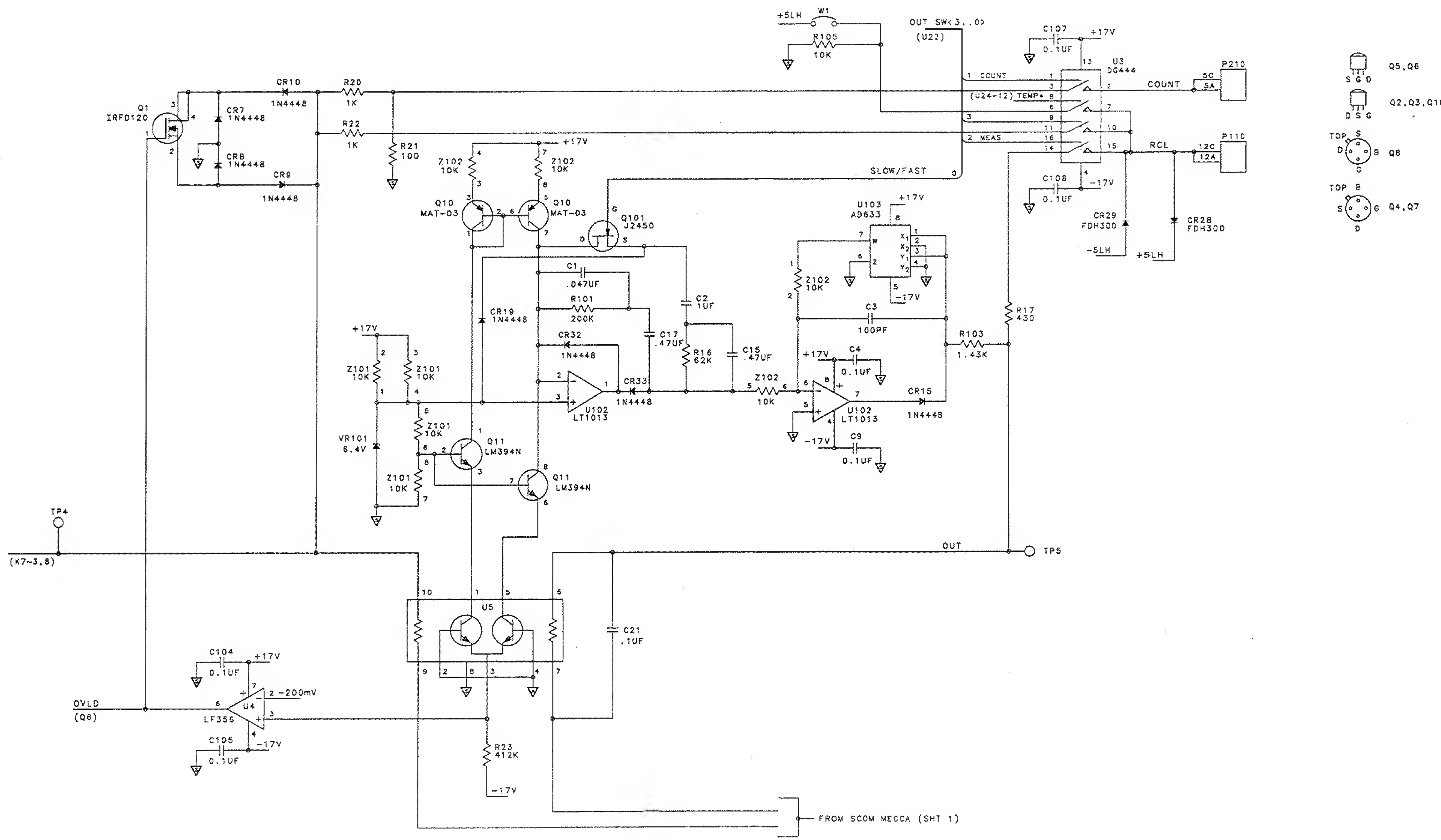
PRECISION AMPLIFIERS

Figure 7-8. A10 Transfer PCA (cont)



THERMAL SENSOR CIRCUIT

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Figure 7-8. A10 Transfer PCA (cont)

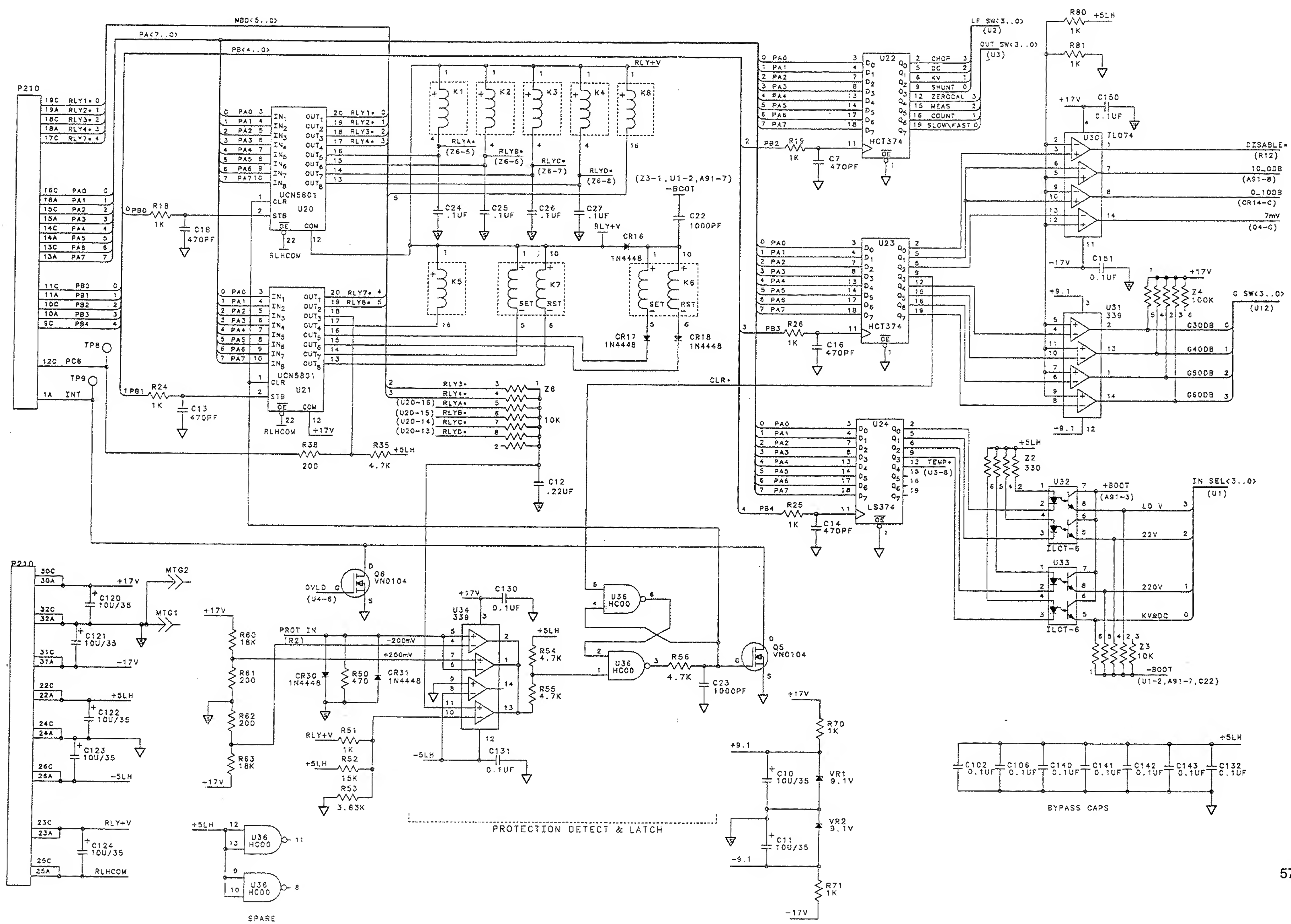

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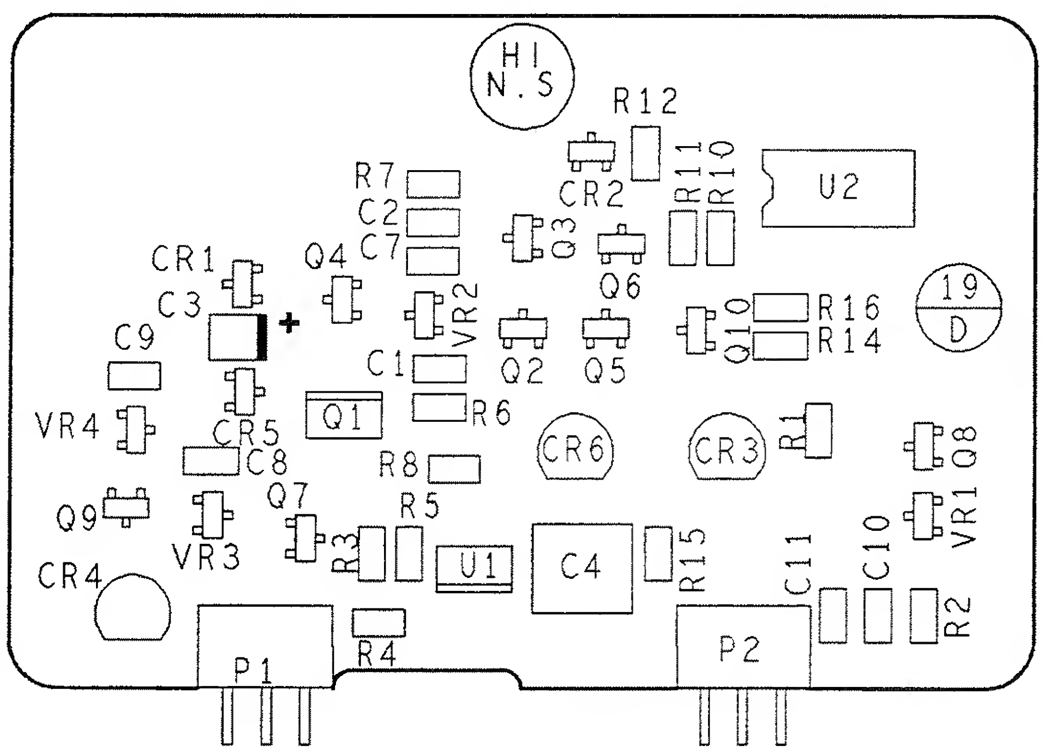
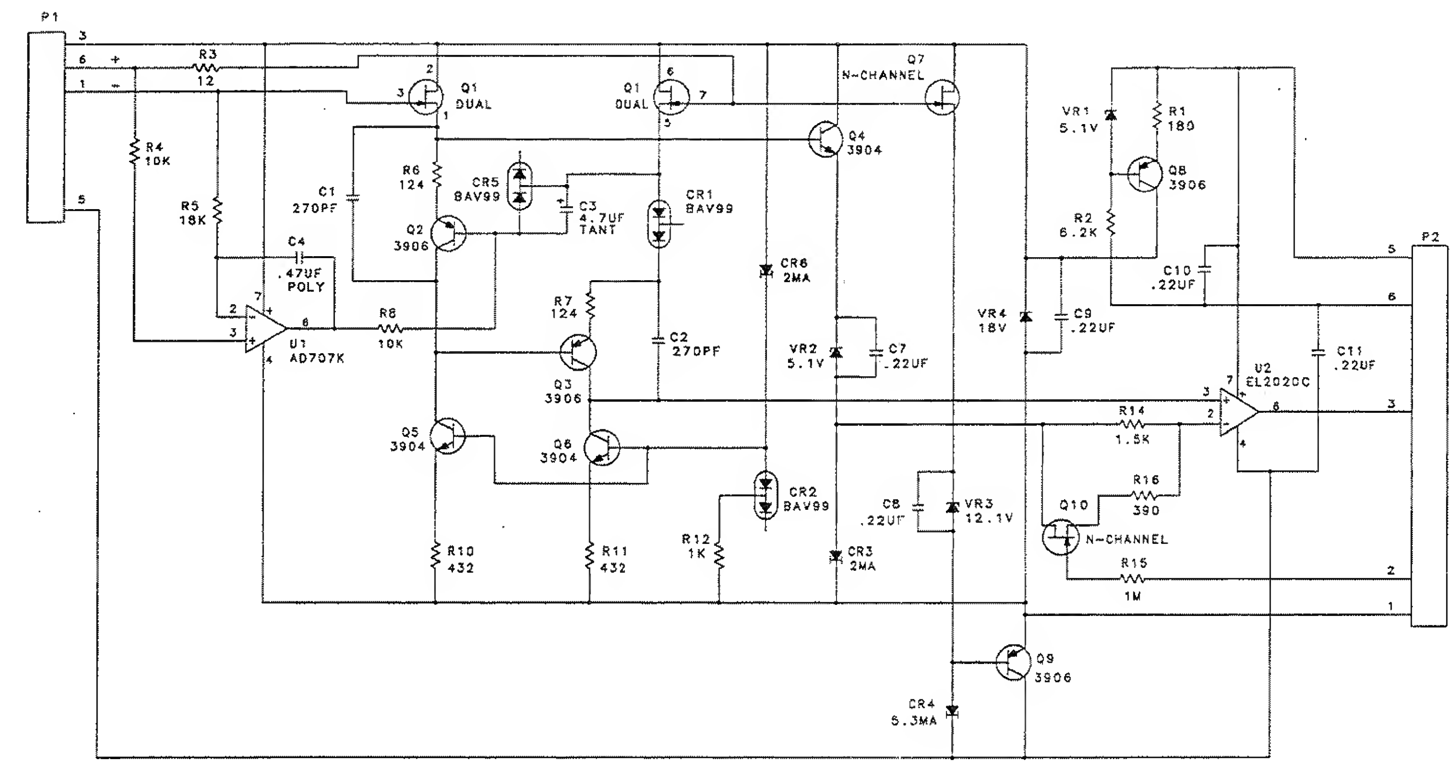
Figure 7-8. A10 Transfer PCA (cont)



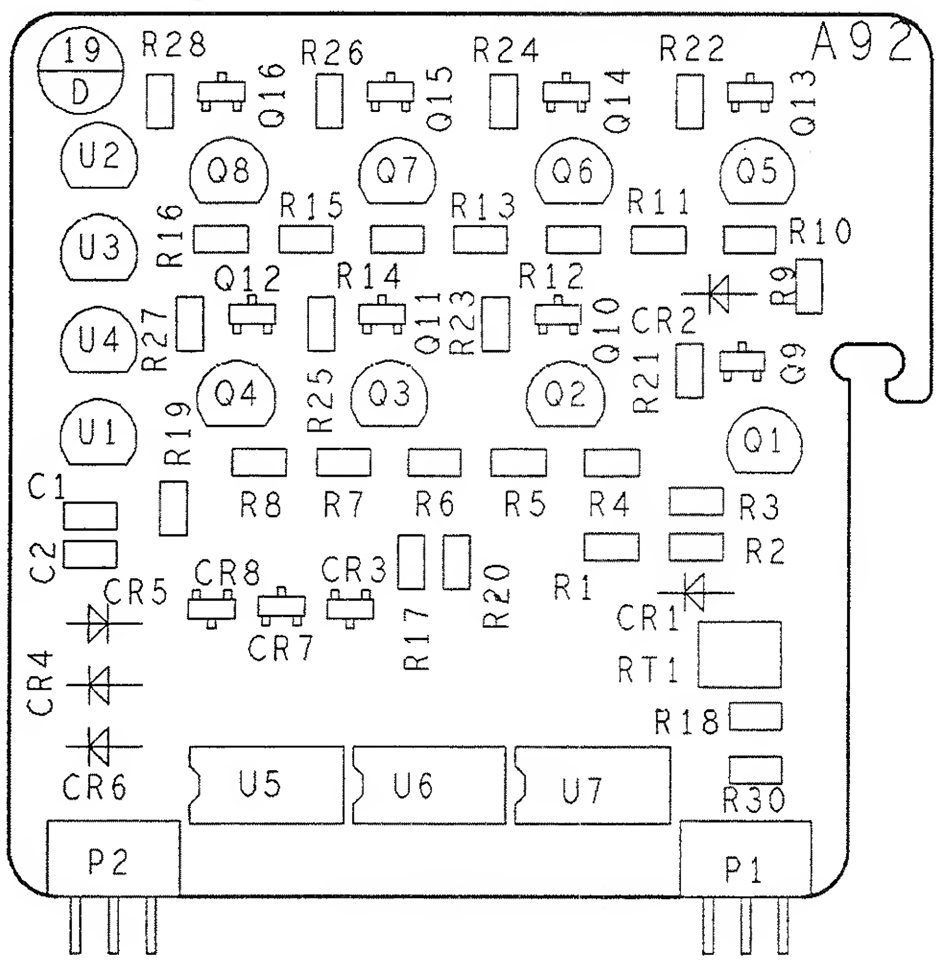
5790A-1691



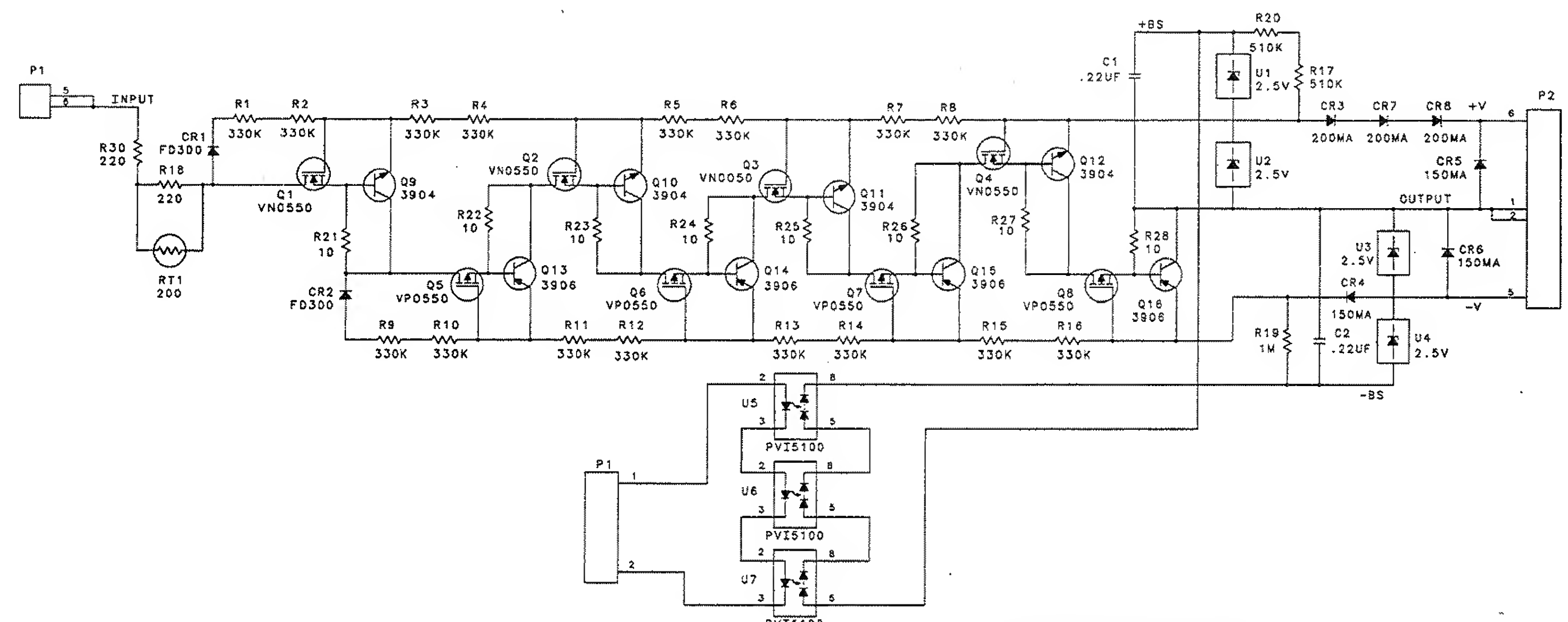
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

5790A-1091

Figure 7-9. A10A1 Precision Amplifier PCA



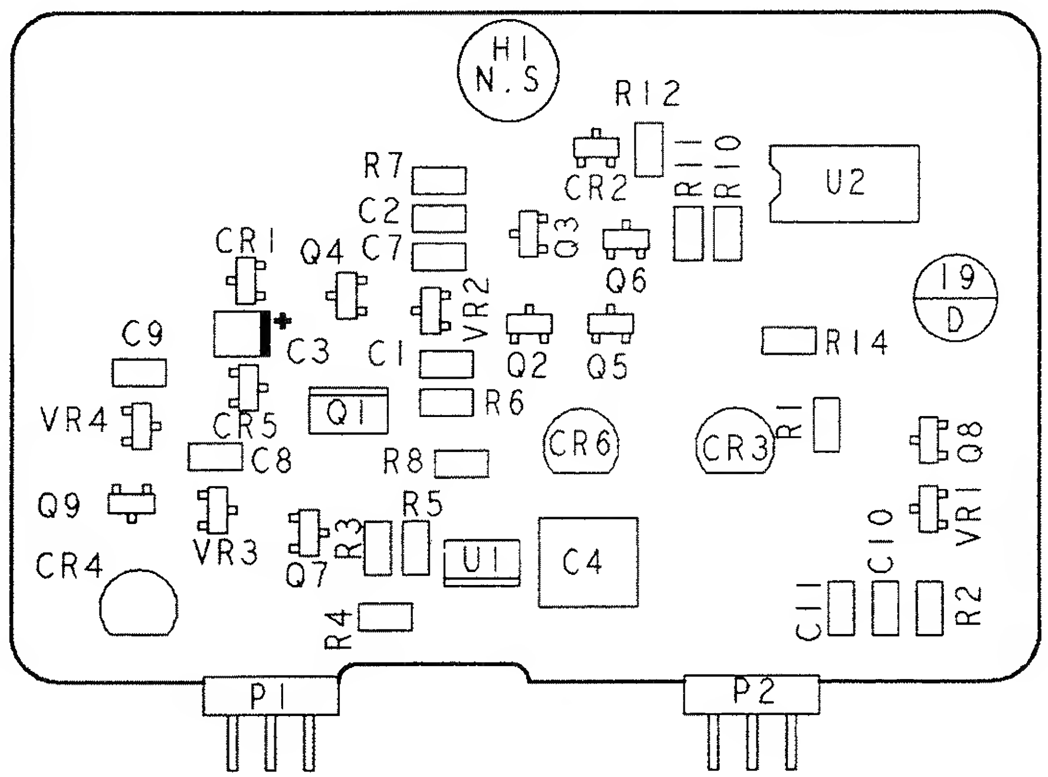
5790A-1692



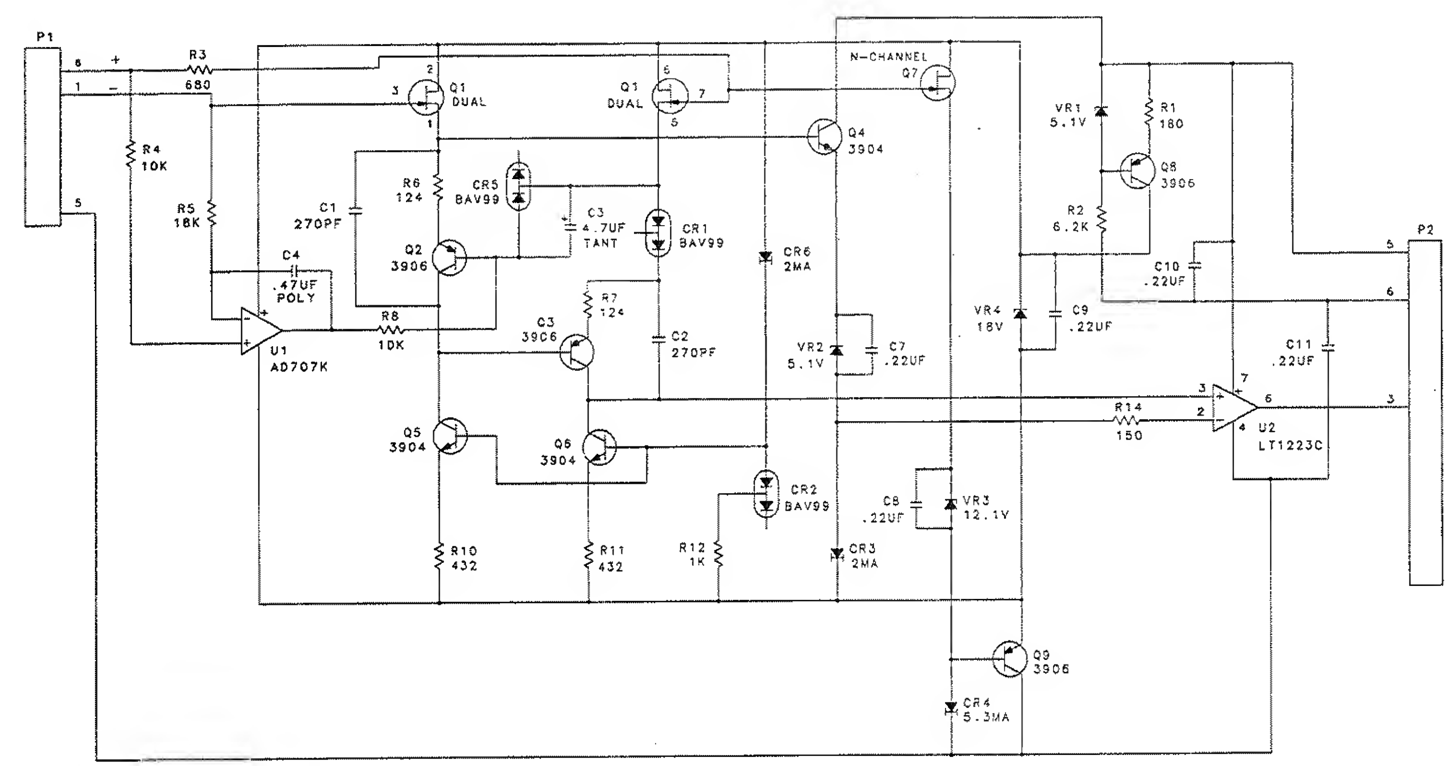
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

5790A-1092

Figure 7-10. A10A2 High Voltage Protection PCA



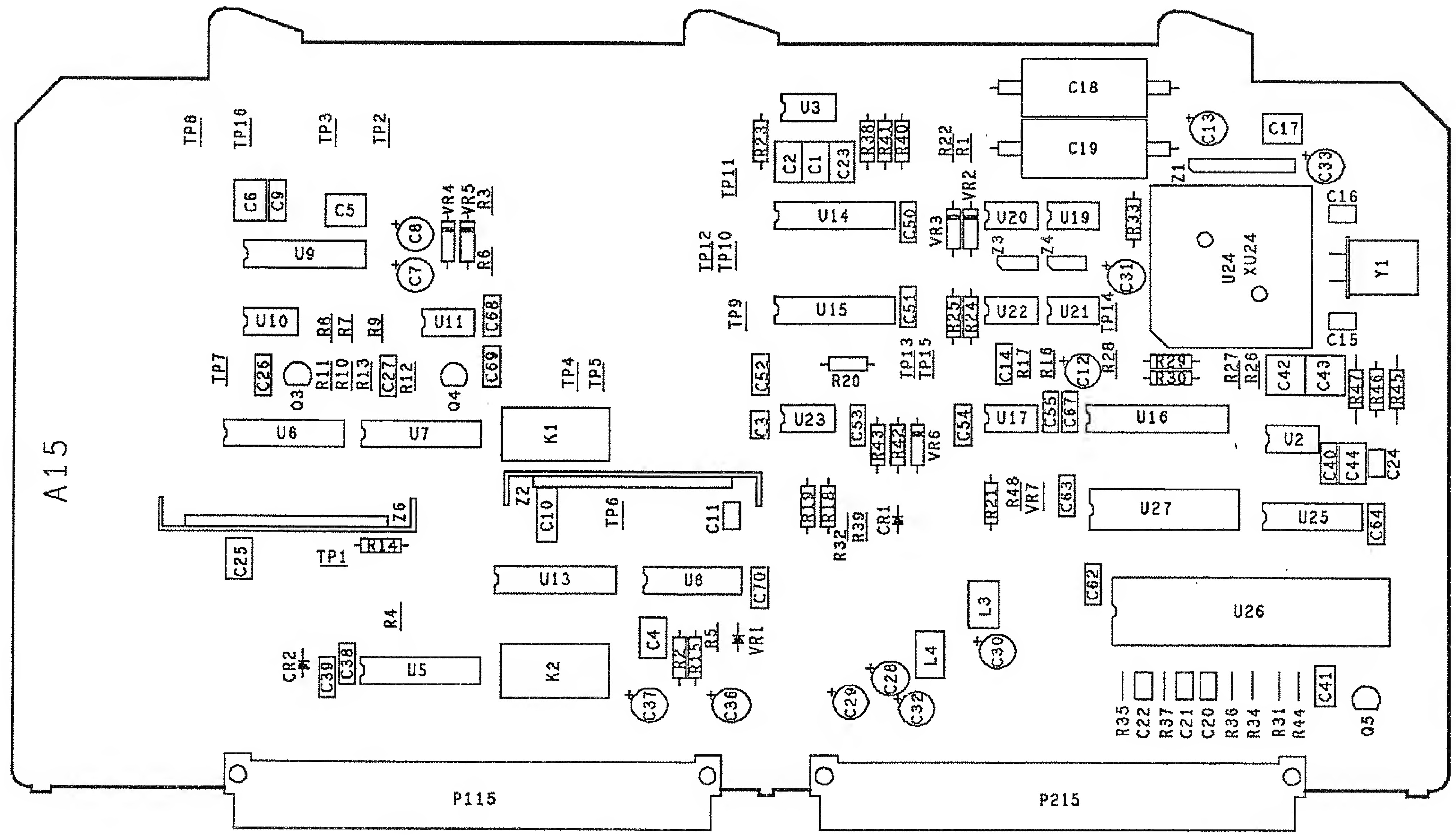
5790A-1695



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

5790A-1095

Figure 7-11. A10A3 High-Gain Precision Amplifier PCA



5790A-1615

Figure 7-12. A15 A/D Amplifier PCA

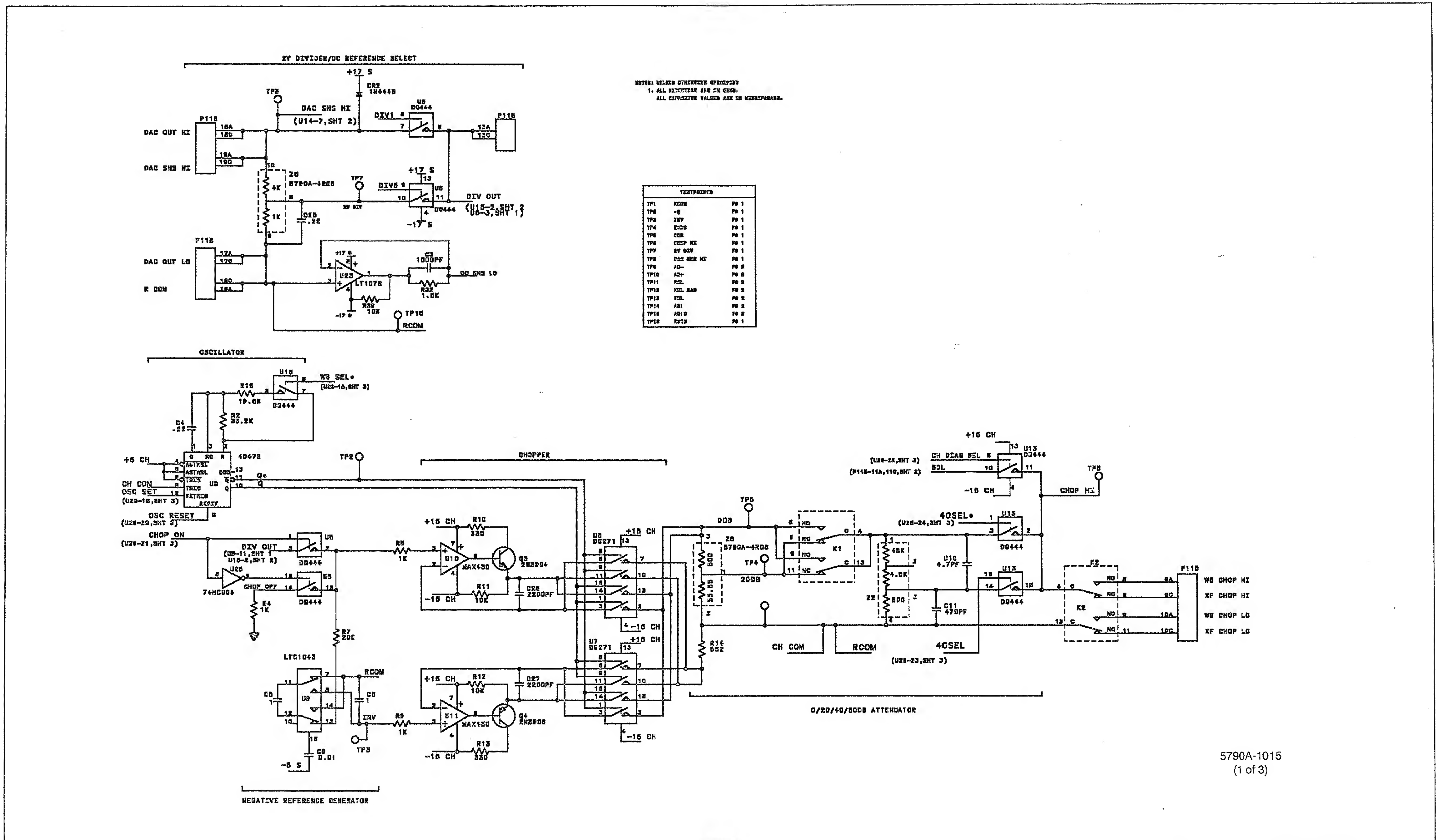


Figure 7-12. A15 A/D Amplifier PCA (cont)

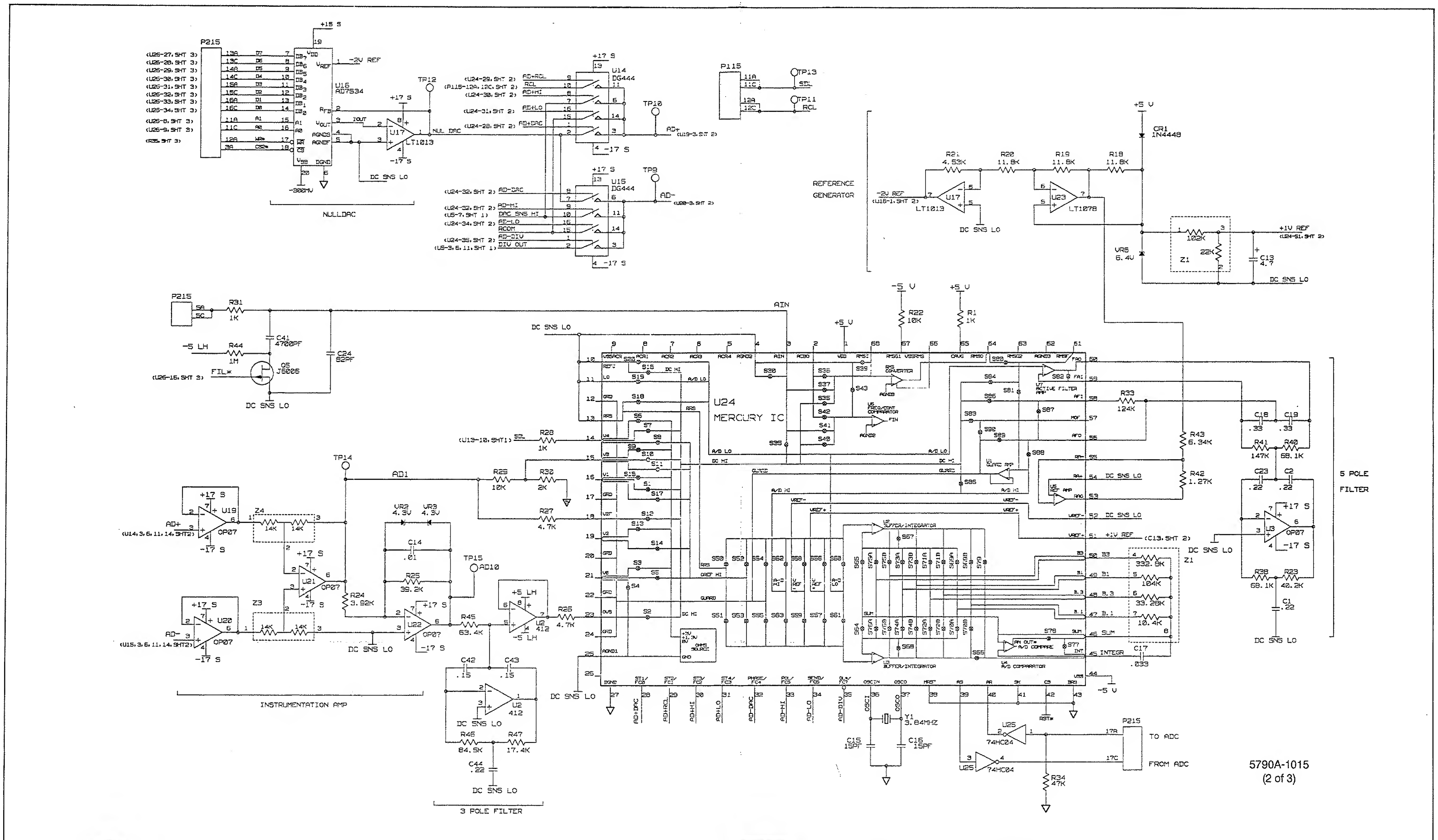
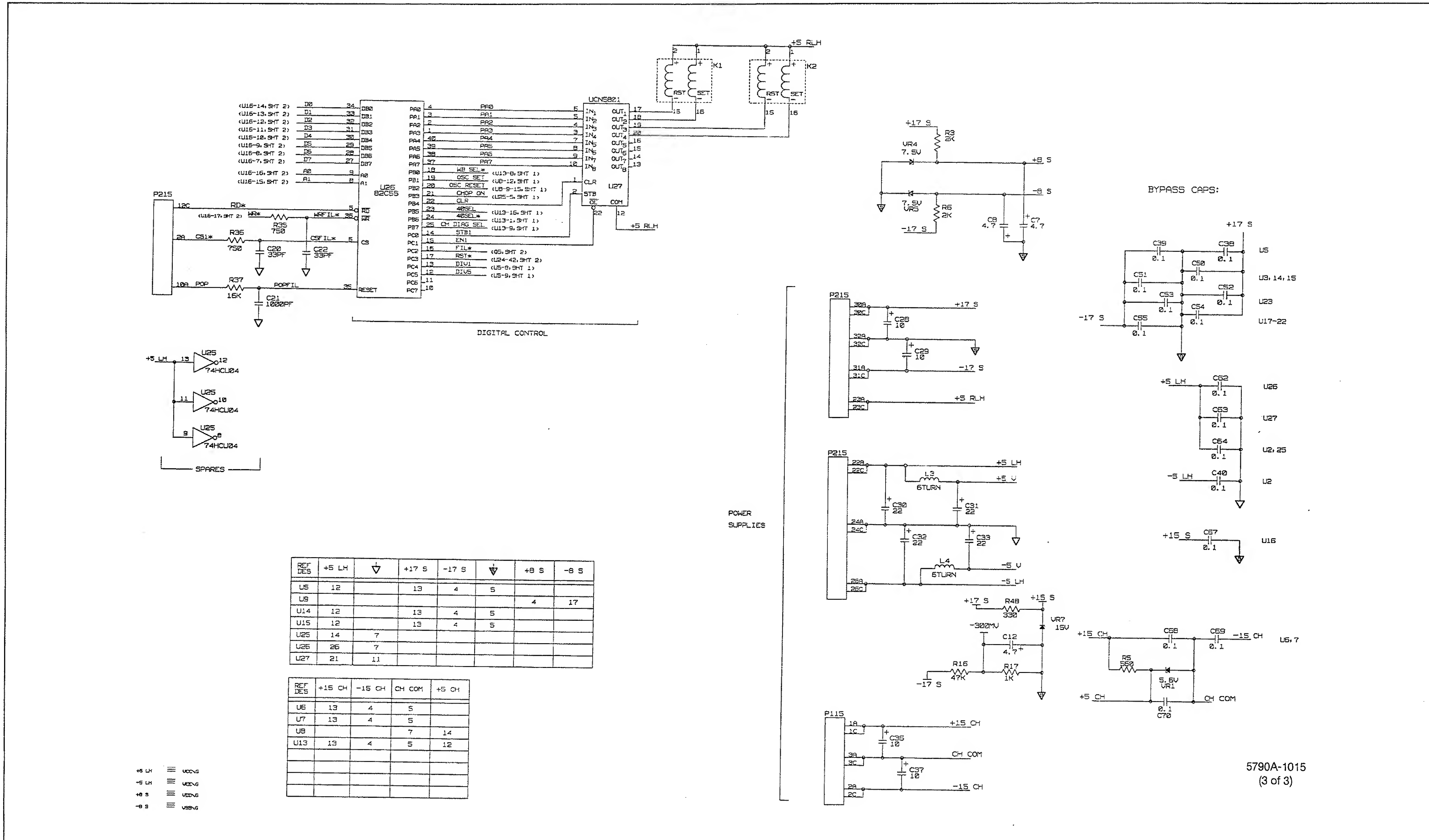


Figure 7-12. A15 A/D Amplifier PCA (cont)



REF DES	+5 LH	⏚	+17 S	-17 S	⏚	+8 S	-8 S
U5	12		13	4	5		
U9						4	17
U14	12		13	4	5		
U15	12		13	4	5		
U25	14	7					
U26	26	7					
U27	21	11					

REF DES	+15 CH	-15 CH	CH COM	+5 CH
U6	13	4	5	
U7	13	4	5	
U8			7	14
U13	13	4	5	12

Figure 7-12. A15 A/D Amplifier PCA (cont)

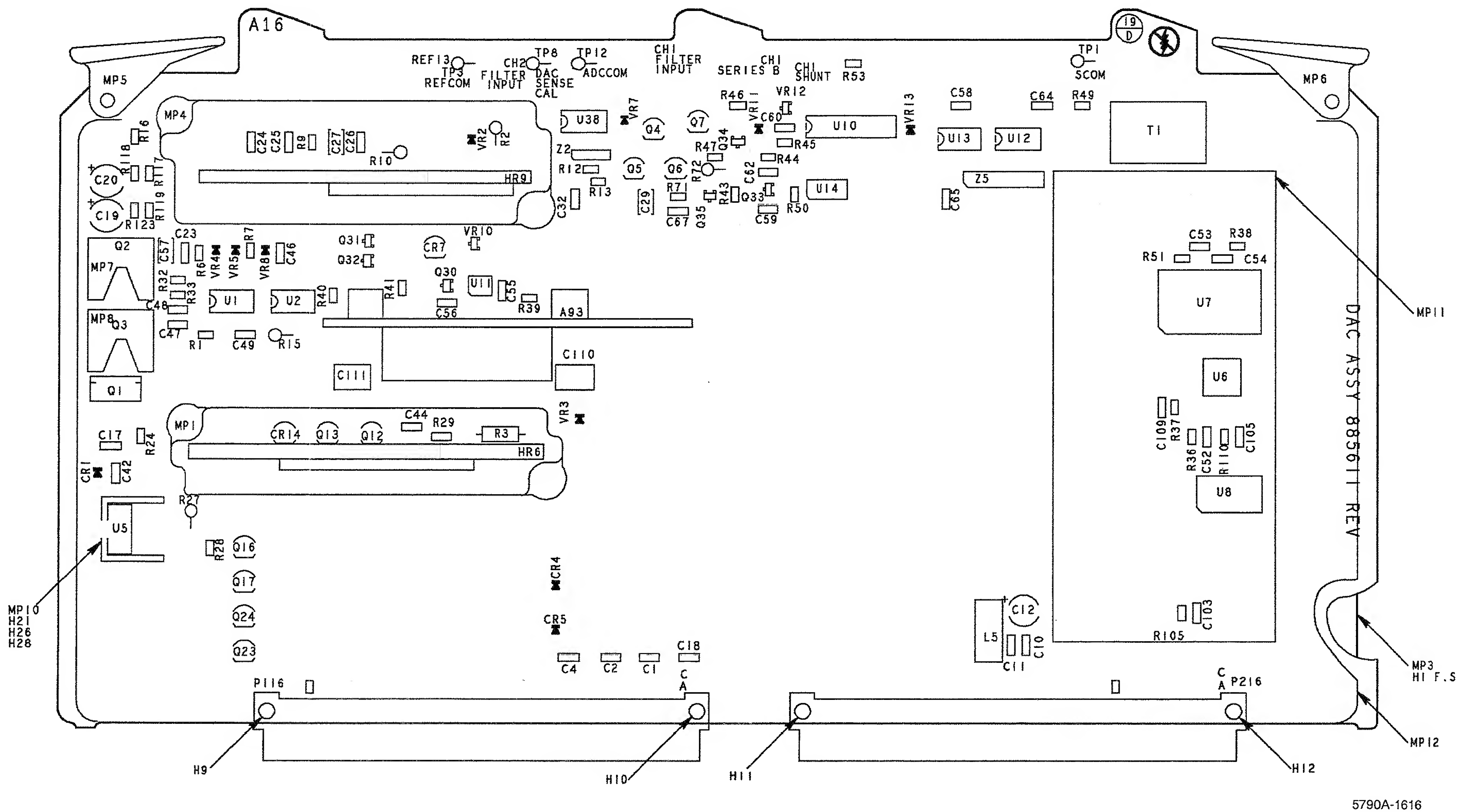
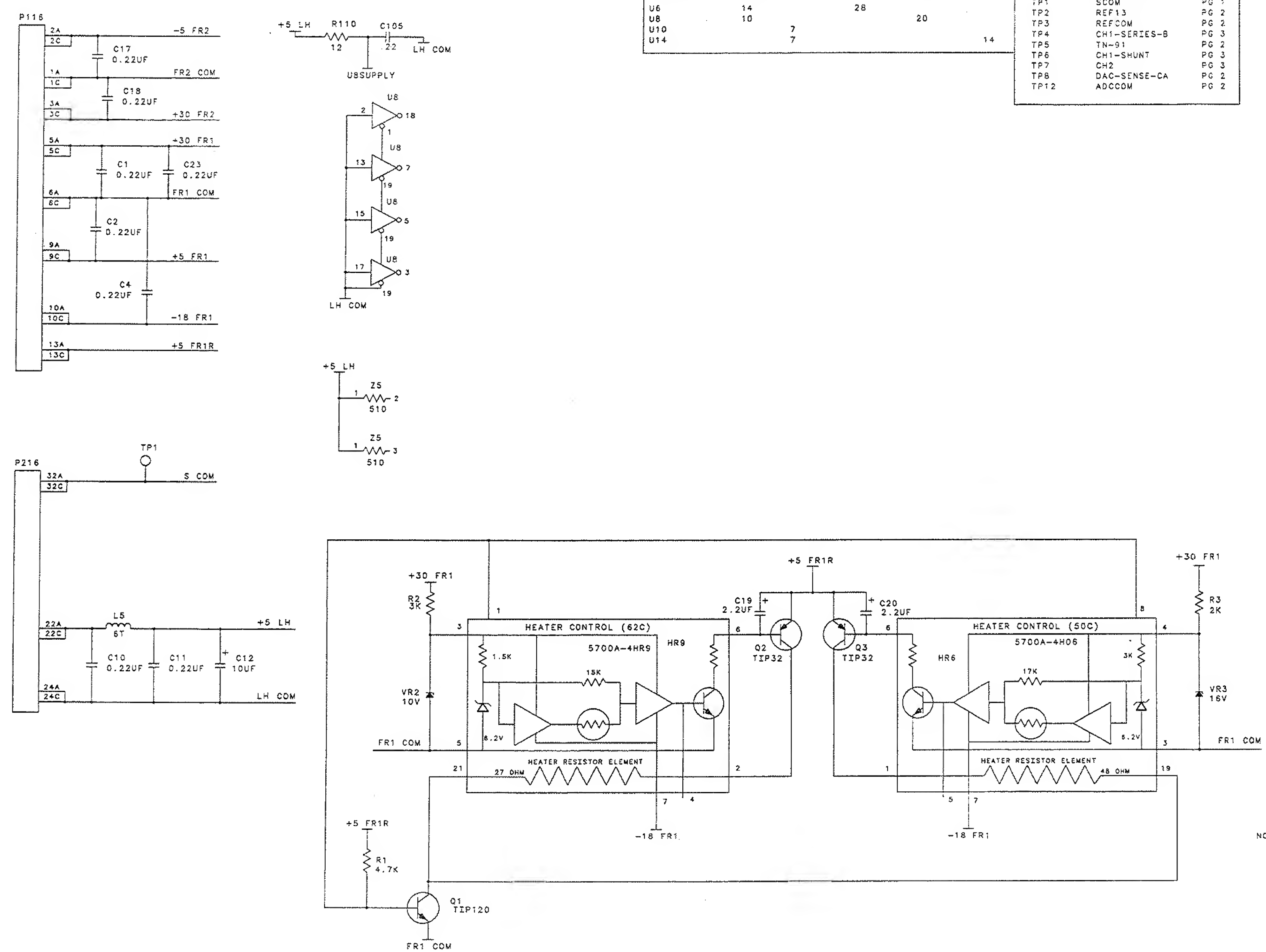


Figure 7-13. A16 DAC PCA

Designator	LHCOM	FR1COM	U6SUPPLY	U8SUPPLY	+5FR1
U6	14		28		
U8	10			20	
U10		7			
U14		7			14

TESTPOINTS		
TP1	SCOM	PG 1
TP2	REF13	PG 2
TP3	REFCOM	PG 2
TP4	CH1-SERIES-B	PG 3
TP5	TN-91	PG 2
TP6	CH1-SHUNT	PG 3
TP7	CH2	PG 3
TP8	DAC-SENSE-CA	PG 2
TP12	ADCCOM	PG 2



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

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Figure 7-13. A16 DAC PCA (cont)

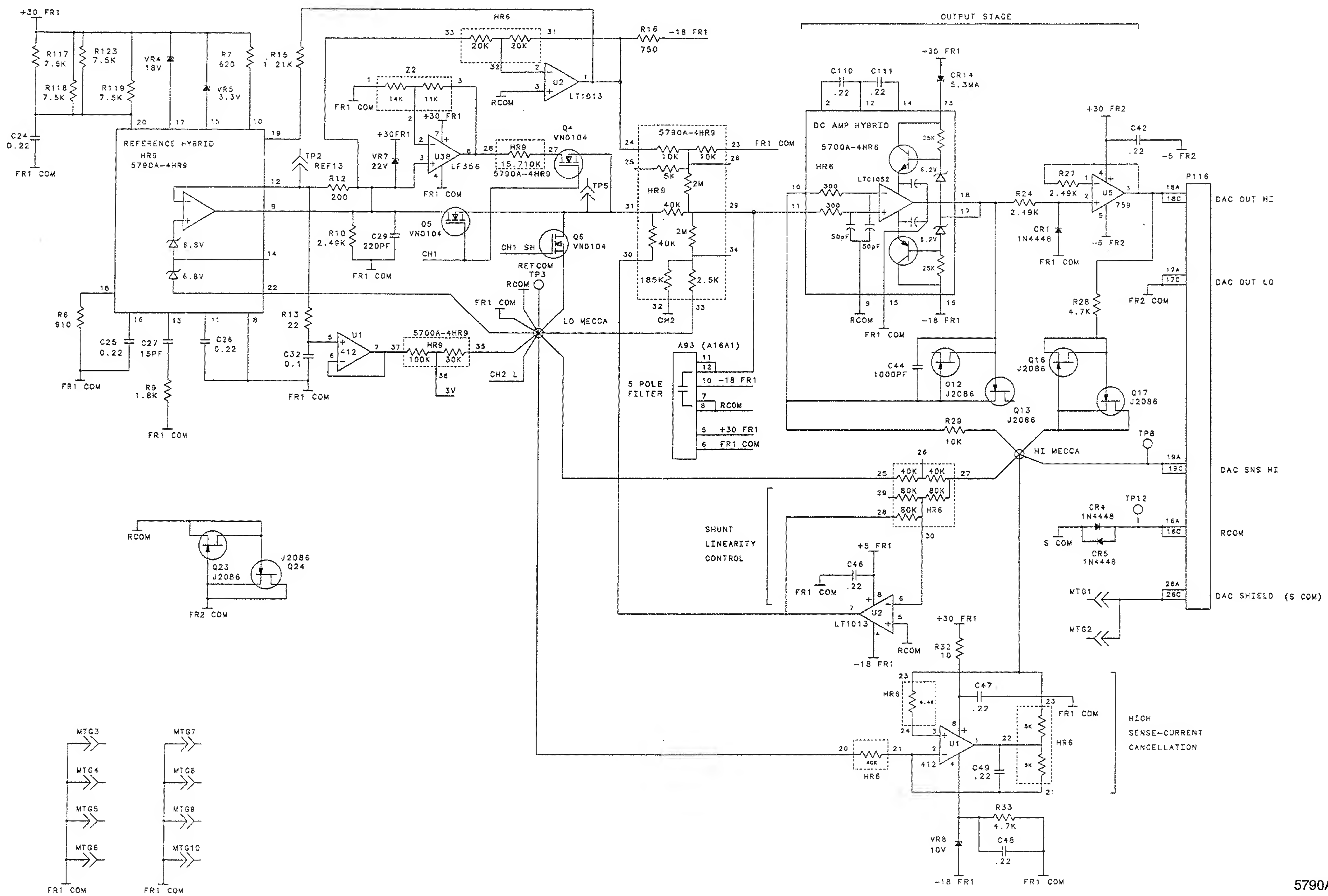

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Figure 7-13. A16 DAC PCA (cont)

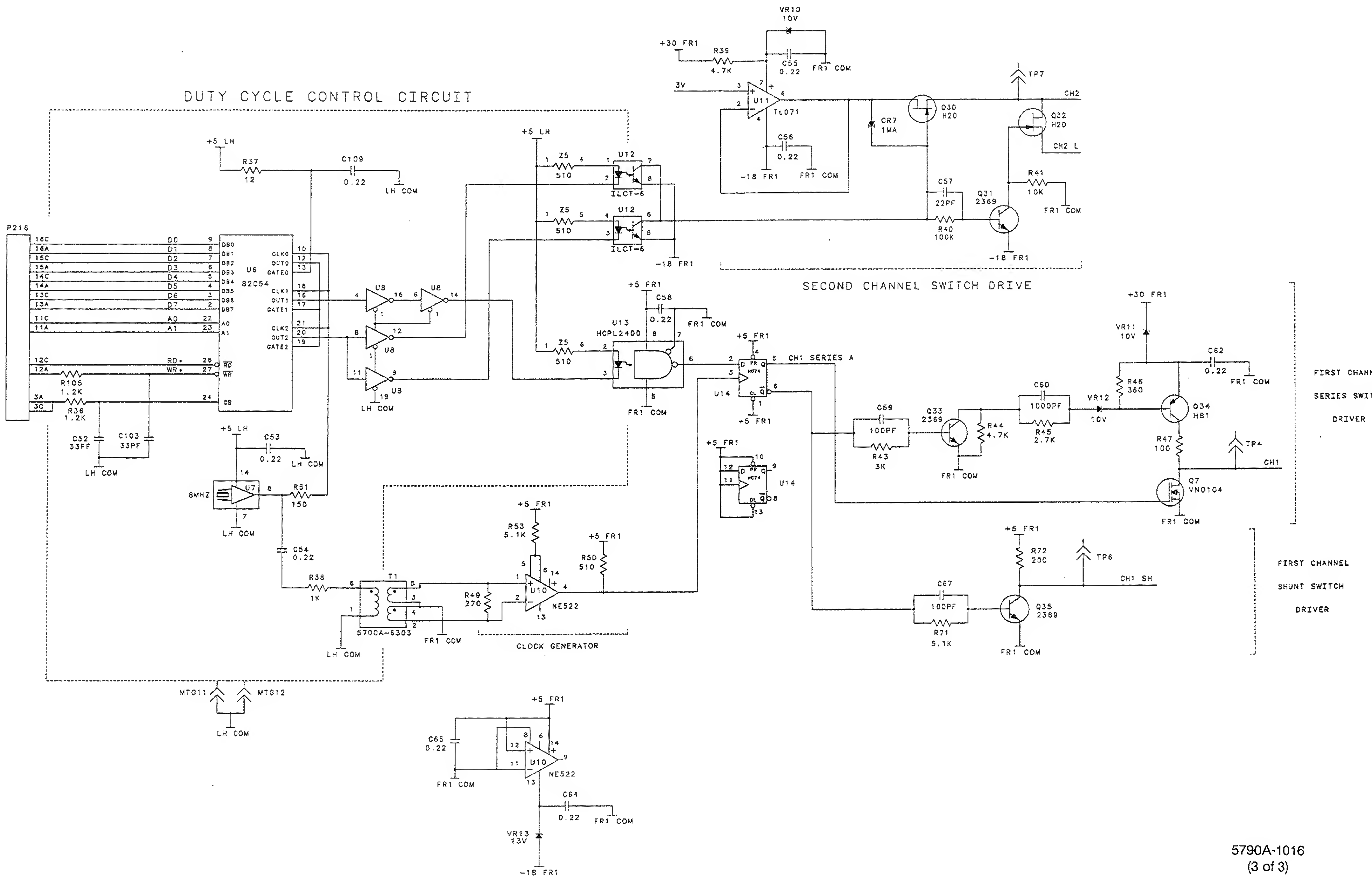

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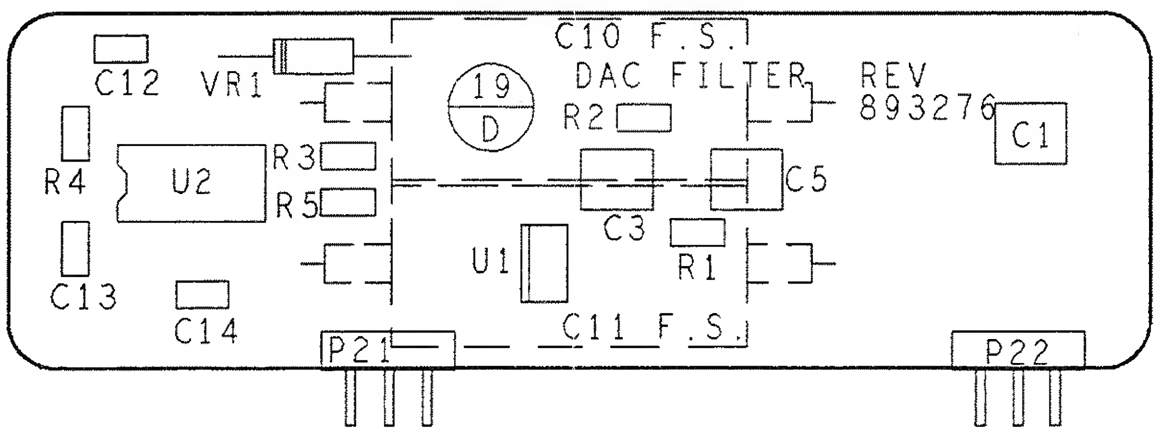
Figure 7-13. A16 DAC PCA (cont)



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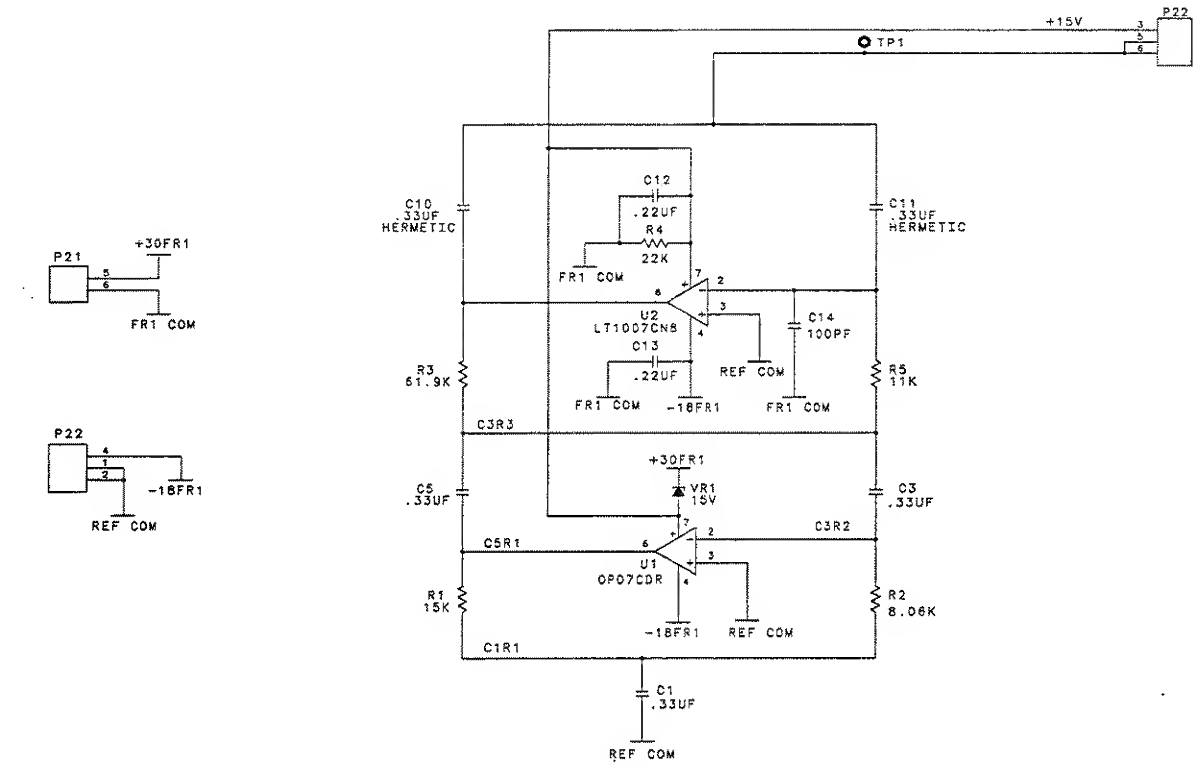


NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

5790A-1093

Figure 7-14. A16A1 DAC Filter PCA

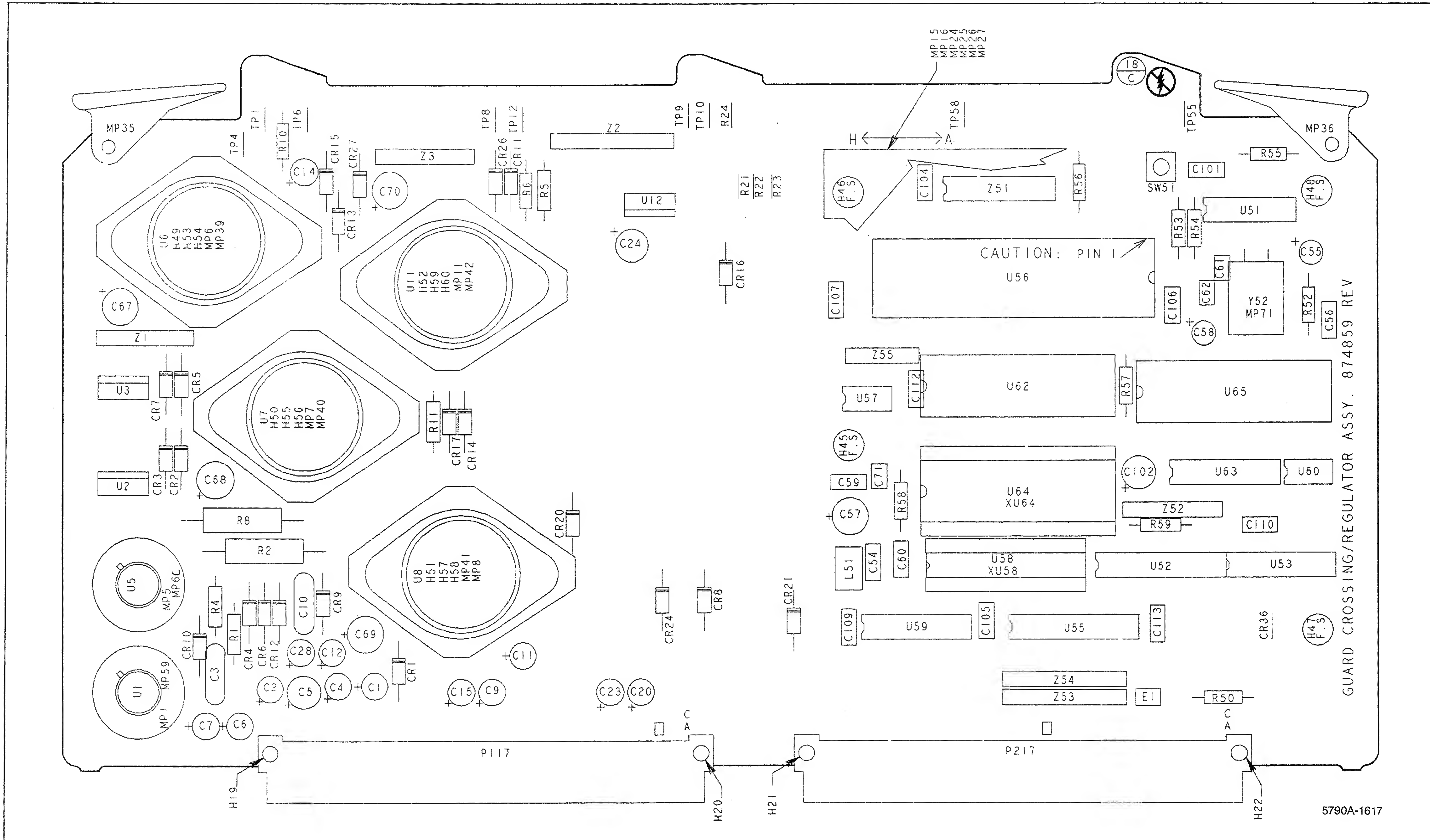
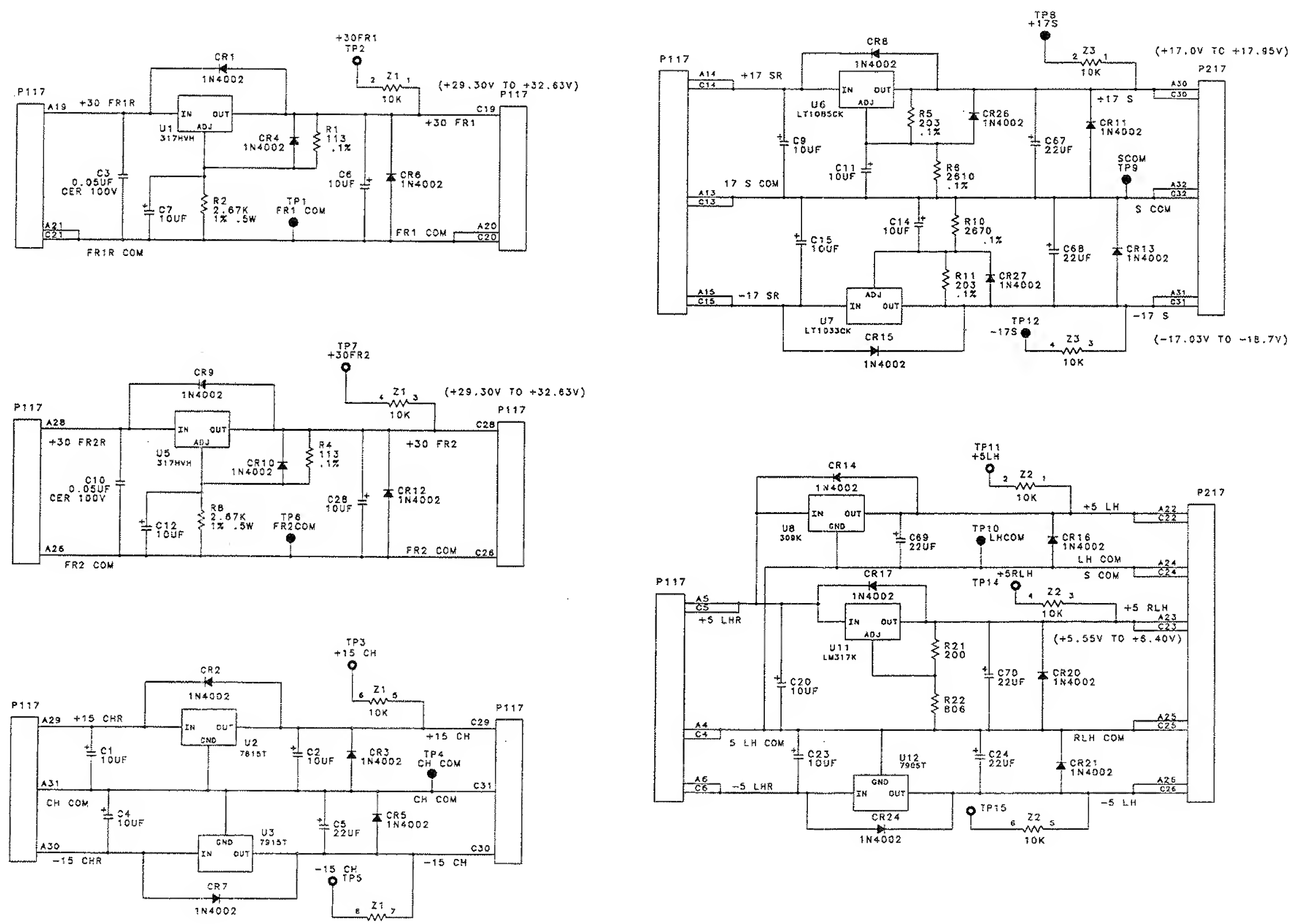


Figure 7-15. A17 Regulator/Guard Crossing PCA

Designator	GND	+5V
U51	7	14
U52	10	20
U53	8	16
U55	10	20
U56	1 42	33
U57	4	8
U58	12	24
U59	8	16
U60	4	8
U62	14	28
U63	8	16
U64	14	28
U65	14	28

TESTPOINTS		
TP1	FR1 COM	PG 1
TP2	+30 FR1	PG 1
TP3	+15 CH	PG 1
TP4	CH COM	PG 1
TP5	-15 CH	PG 1
TP6	FR2 COM	PG 1
TP7	+30 FR2	PG 1
TP8	+17 S	PG 1
TP9	GND	PG 1
TP10	GND	PG 1
TP11	+5 LH	PG 1
TP12	-17 S	PG 1
TP14	+5 RLH	PG 1
TP15	-5 LH	PG 1
TP52	+5V	PG 2
TP55	GND	PG 2
TP58	GND	PG 2



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

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Figure 7-15. A17 Regulator/Guard Crossing PCA (cont)

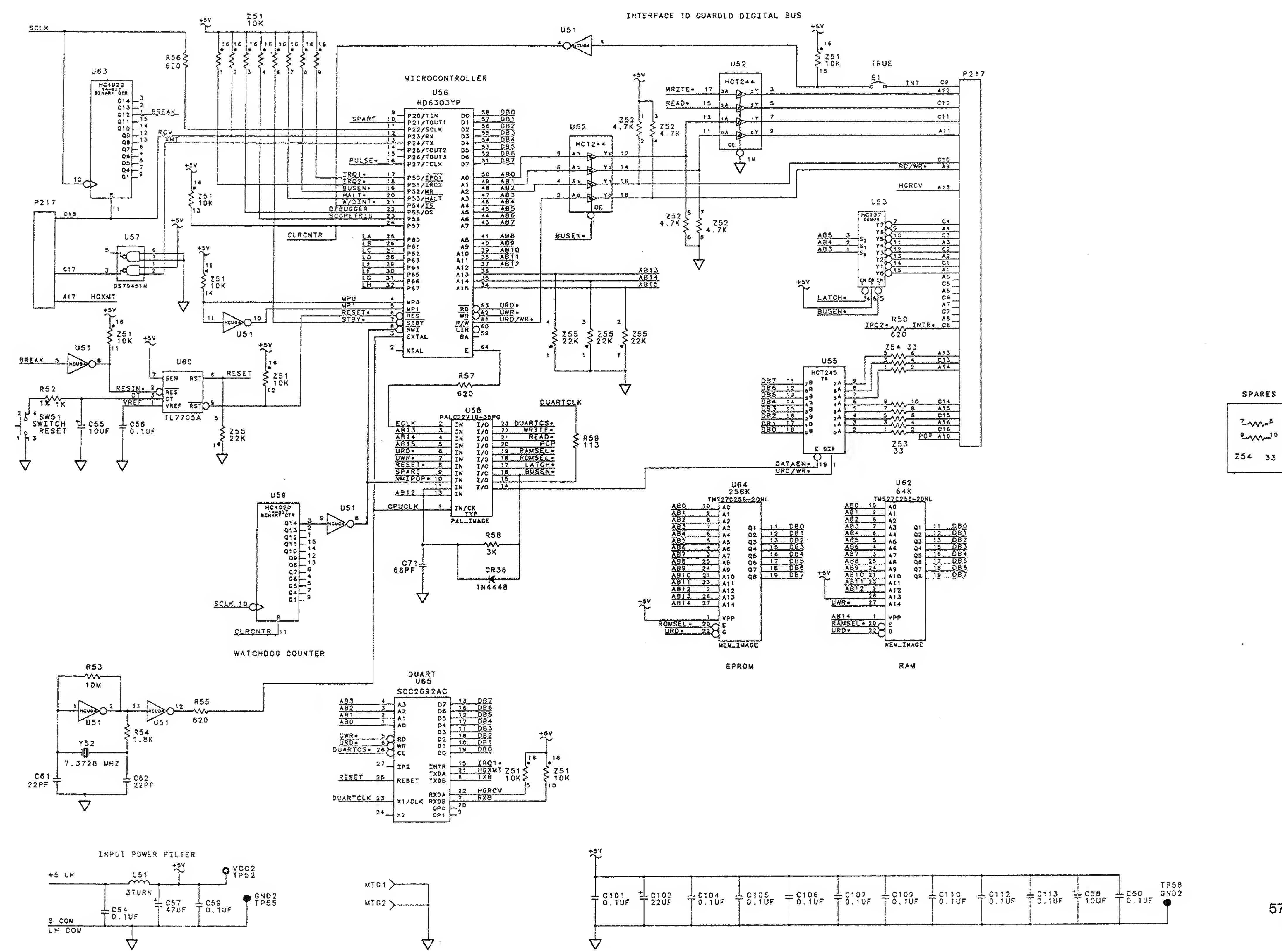

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Figure 7-15. A17 Regulator/Guard Crossing PCA (cont)

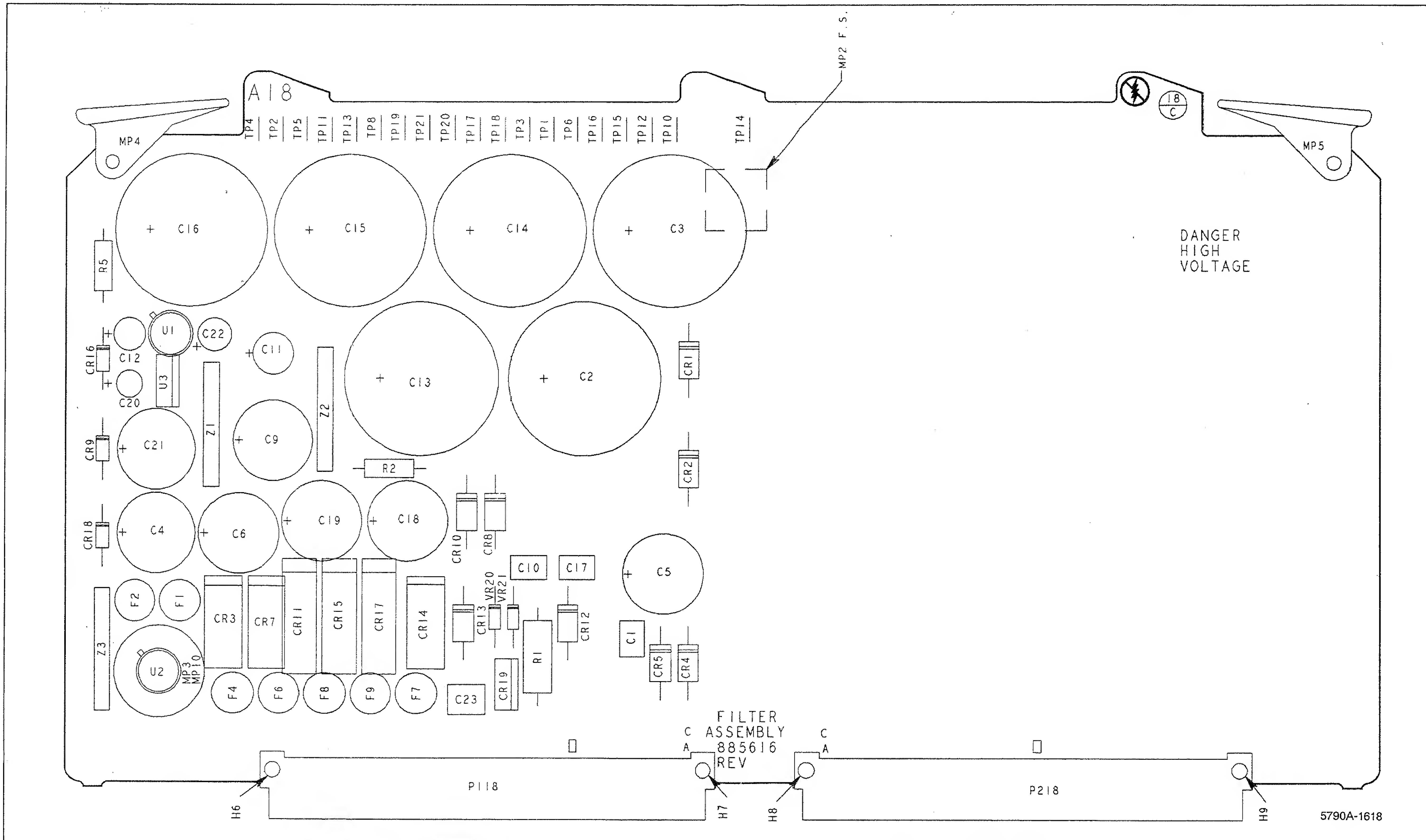
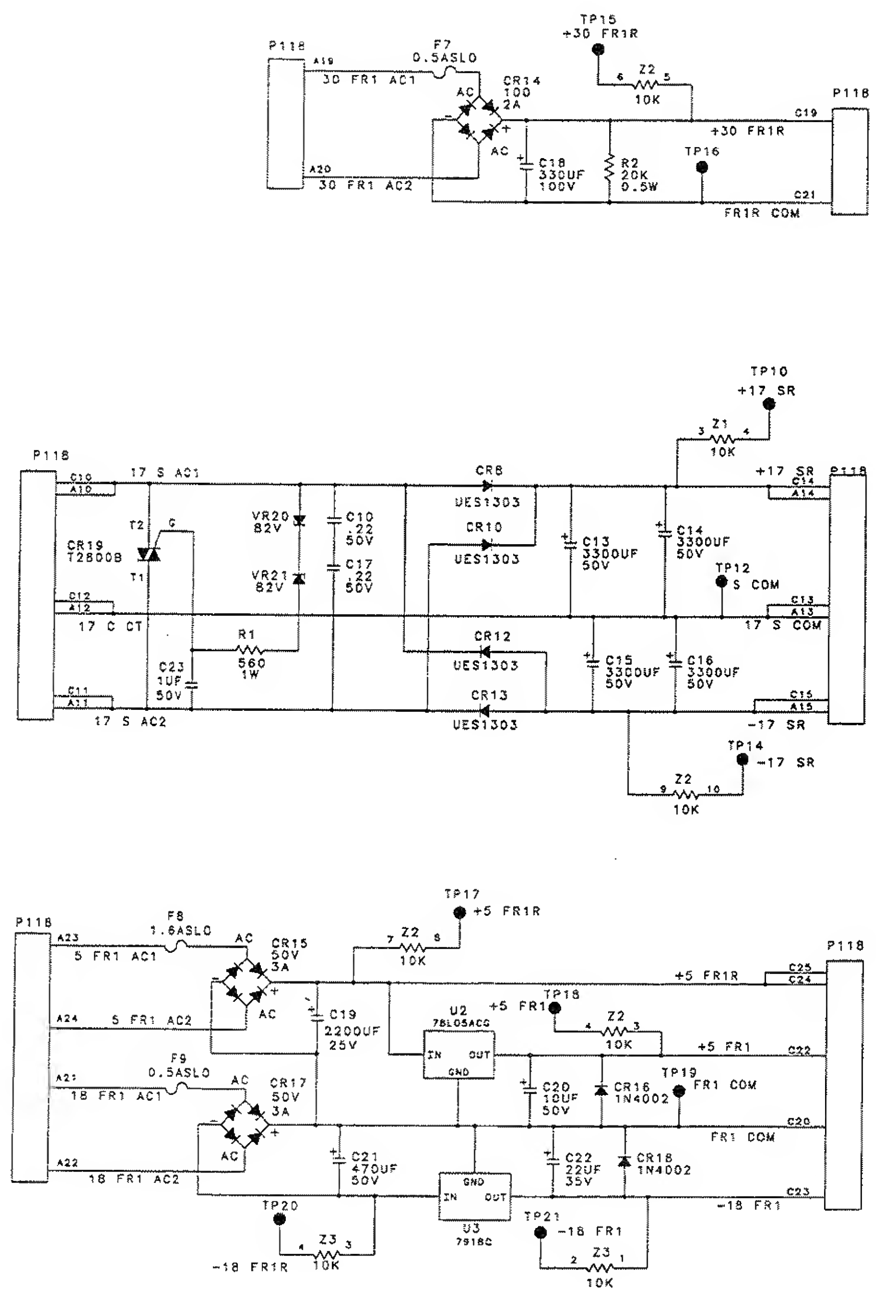


Figure 7-16. A18 Filter PCA



TESTPOINTS		
TP1	+5LHR	PG 2
TP2	+15CHR	PG 2
TP3	5 LH COM	PG 2
TP4	CH COM	PG 2
TP5	-15CHR	PG 2
TP6	-5LHR	PG 2
TP7	+44SR	PG 3
TP8	+30FR2	PG 2
TP9	-44SR	PG 3
TP10	+17SR	PG 1
TP11	FR2 COM	PG 2
TP12	17 S COM	PG 1
TP13	-5FR2	PG 2
TP14	-17SR	PG 1
TP15	+30FR1R	PG 1
TP16	FR1R COM	PG 1
TP17	+5FR1R	PG 1
TP18	+5FR1	PG 1
TP19	FR1 COM	PG 1
TP20	-18 FR1R	PG 1
TP21	-18FR1	PG 1
TP22	44 S CT	PG 3

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

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(1 of 2)

Figure 7-16. A18 Filter PCA (cont)

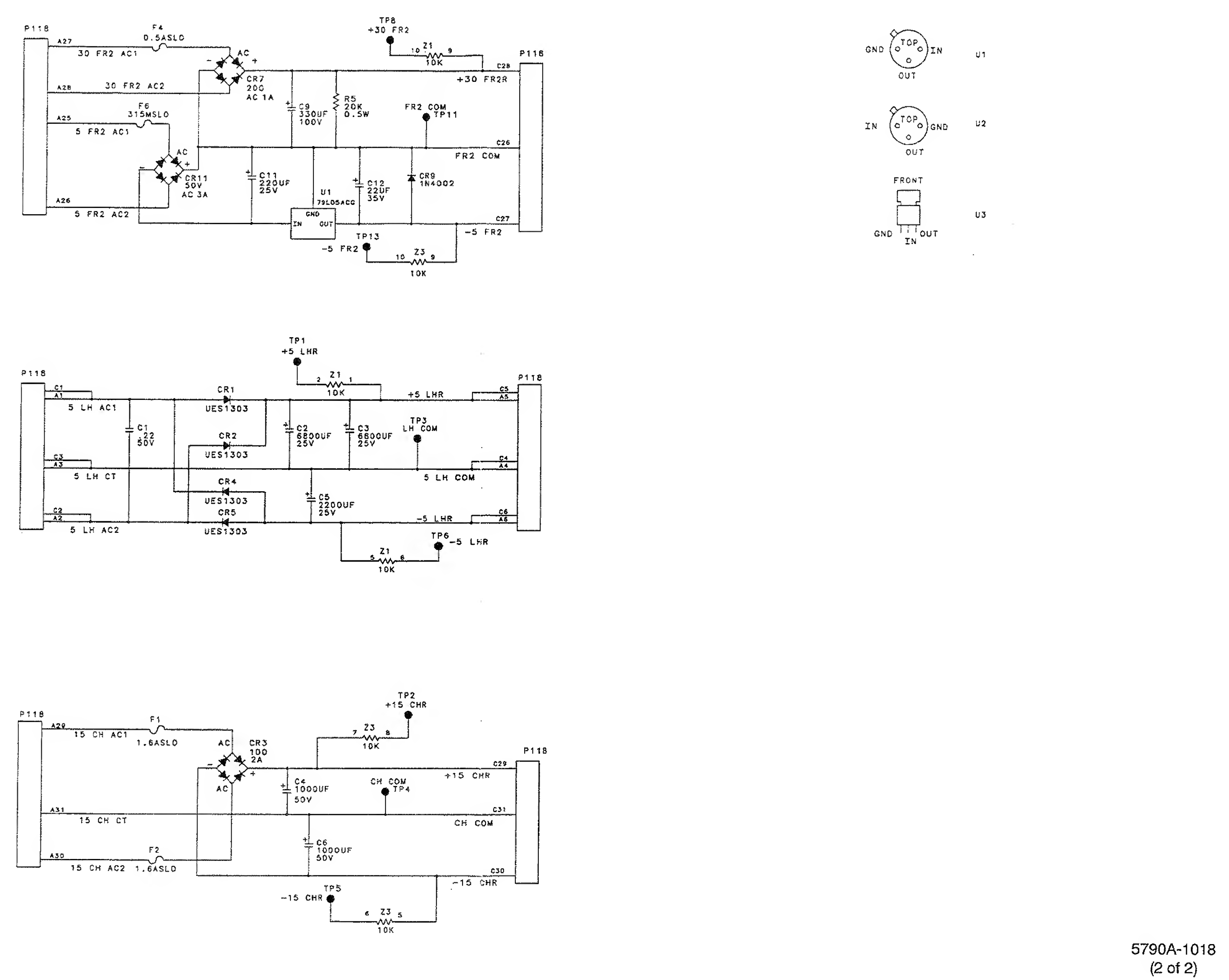
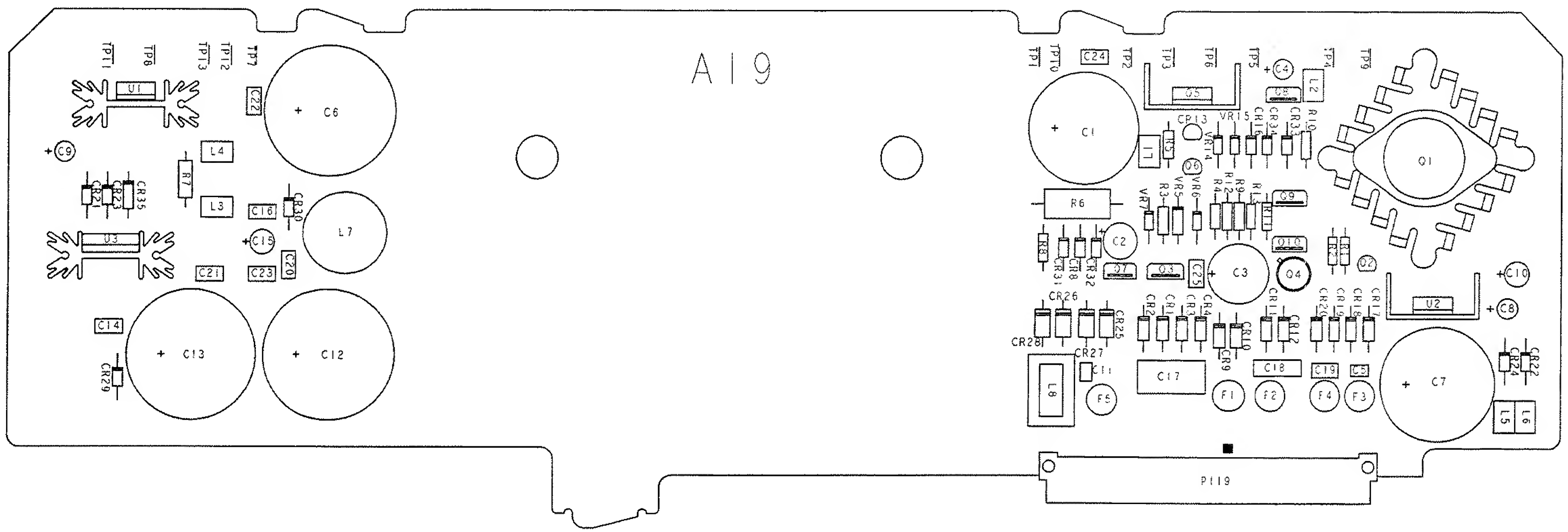


Figure 7-16. A18 Filter PCA (cont)

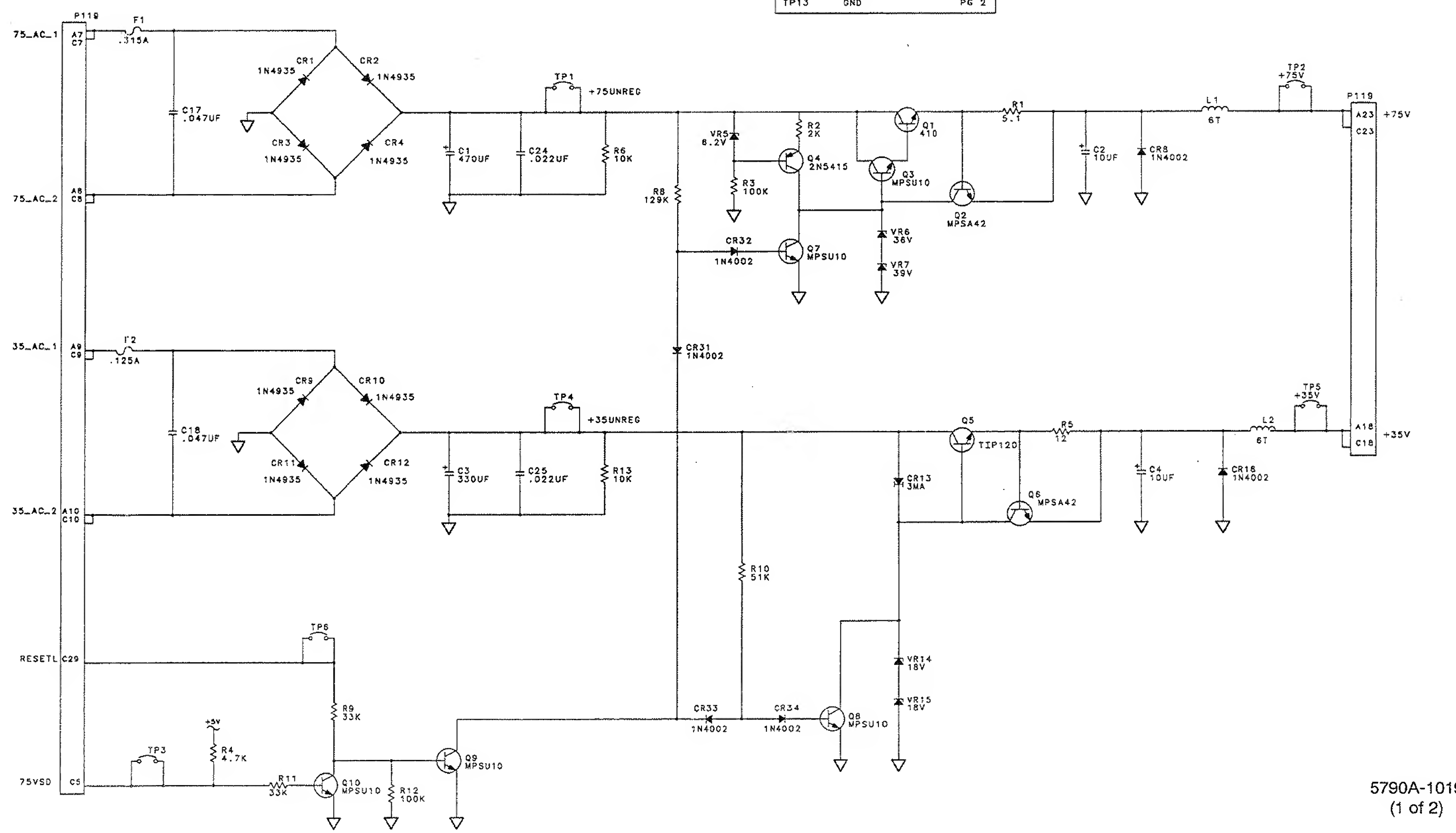


5790A-1619

Figure 7-17. A19 Digital Power Supply PCA

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

TESTPOINTS		
TP1	+75UNREG	PG 1
TP2	+75V	PG 1
TP3	75VSD	PG 1
TP4	+35UNREG	PG 1
TP5	+35V	PG 1
TP6	RESETL	PG 1
TP7	+12VUR	PG 2
TP8	+12V	PG 2
TP9	-12VUR	PG 2
TP10	-12V	PG 2
TP11	+5VUR	PG 2
TP12	+5V	PG 2
TP13	GND	PG 2



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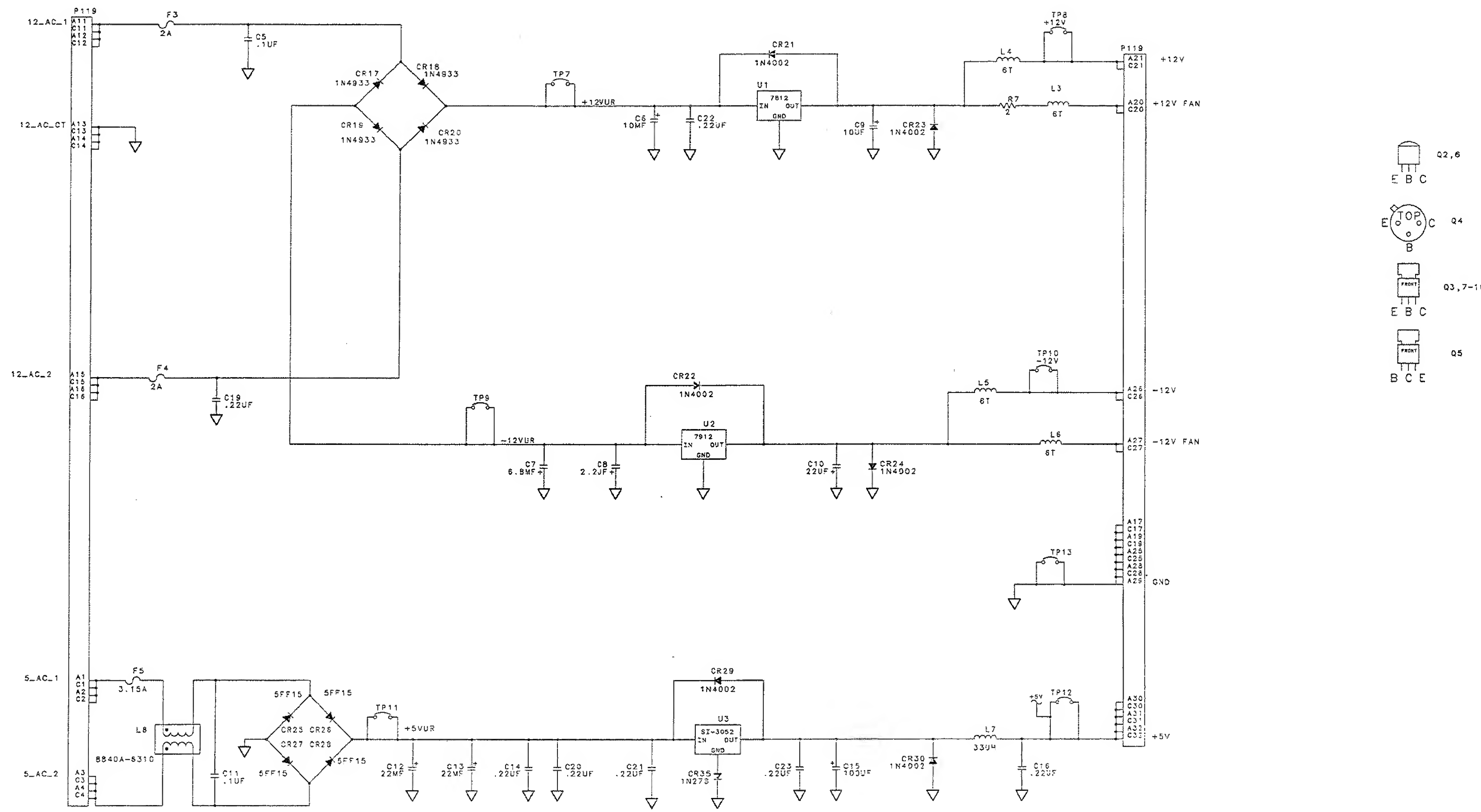
(1 of 2)

Figure 7-17. A19 Digital Power Supply PCA (cont)



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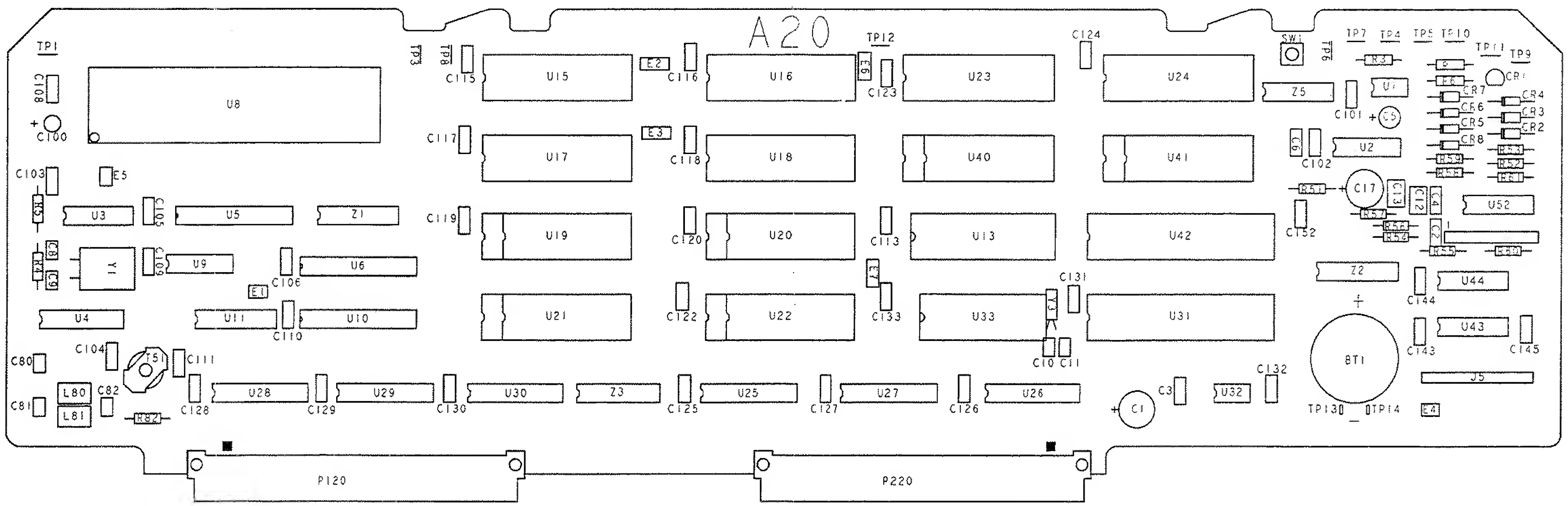
(2 of 2)

Figure 7-17. A19 Digital Power Supply PCA (cont)



5790A-1620

Figure 7-18. A20 CPU PCA

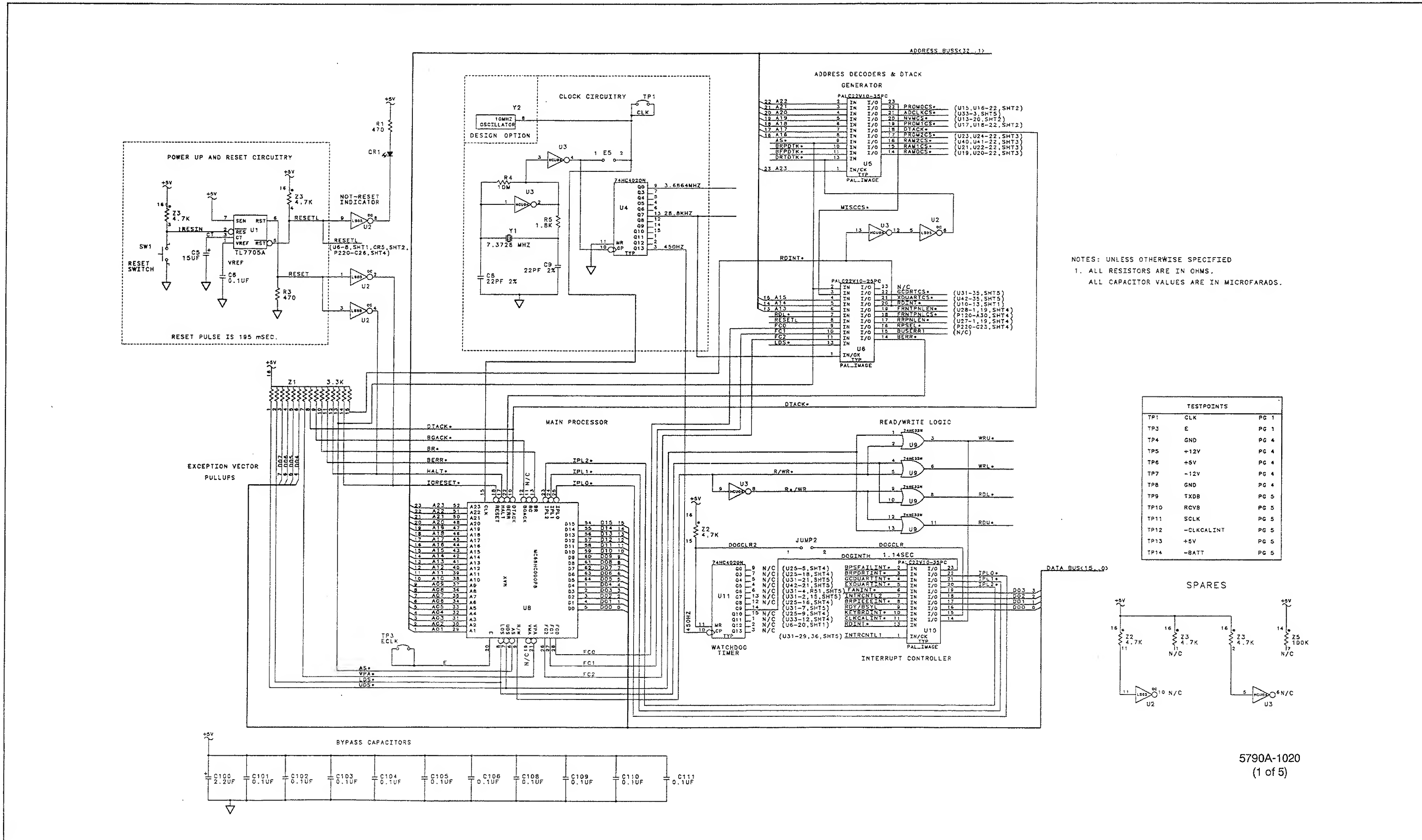
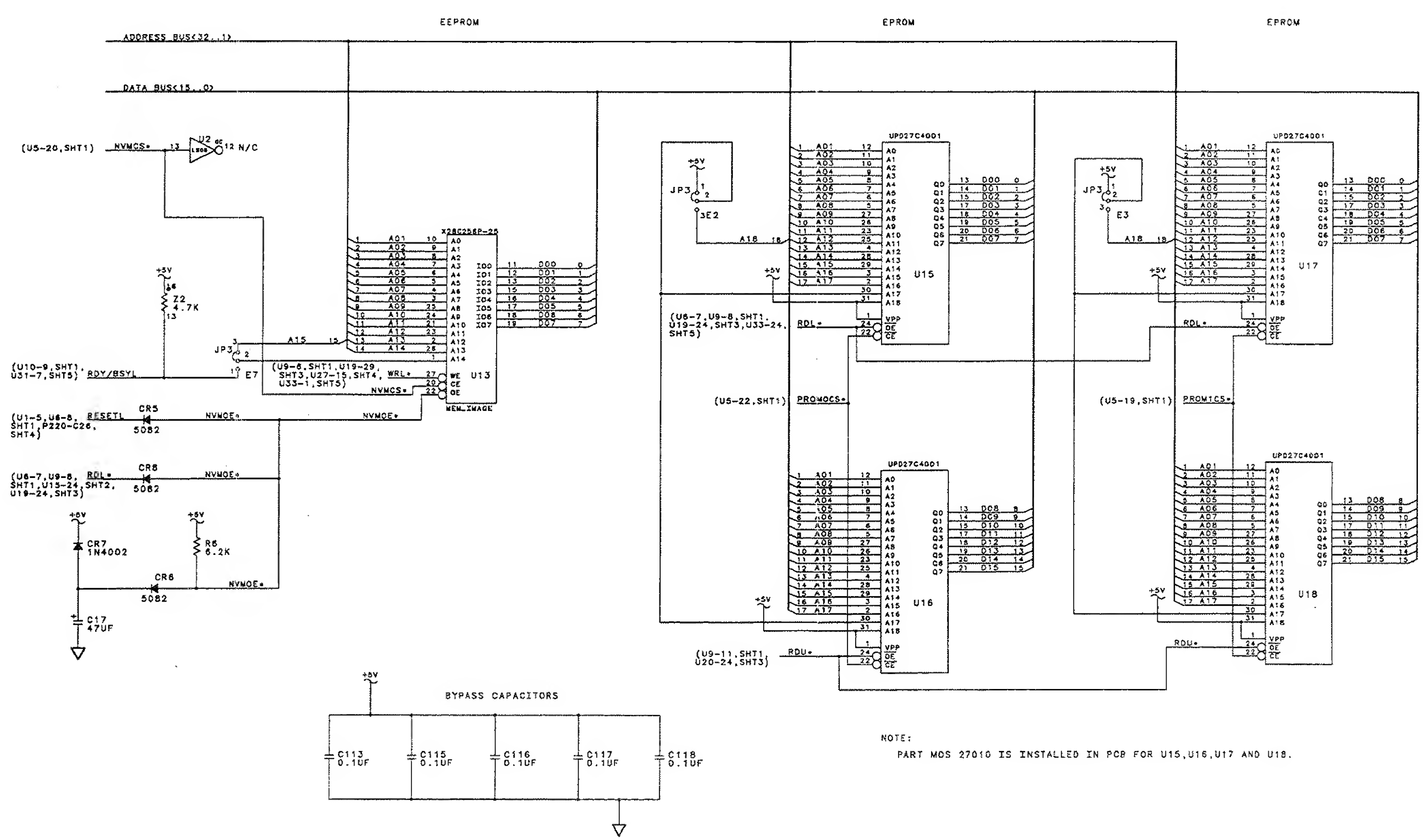


Figure 7-18. A20 CPU PCA (cont)



NOTE:
PART MOS 27010 IS INSTALLED IN PCB FOR U15,U16,U17 AND U18.

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(2 of 5)

Figure 7-18. A20 CPU PCA (cont)

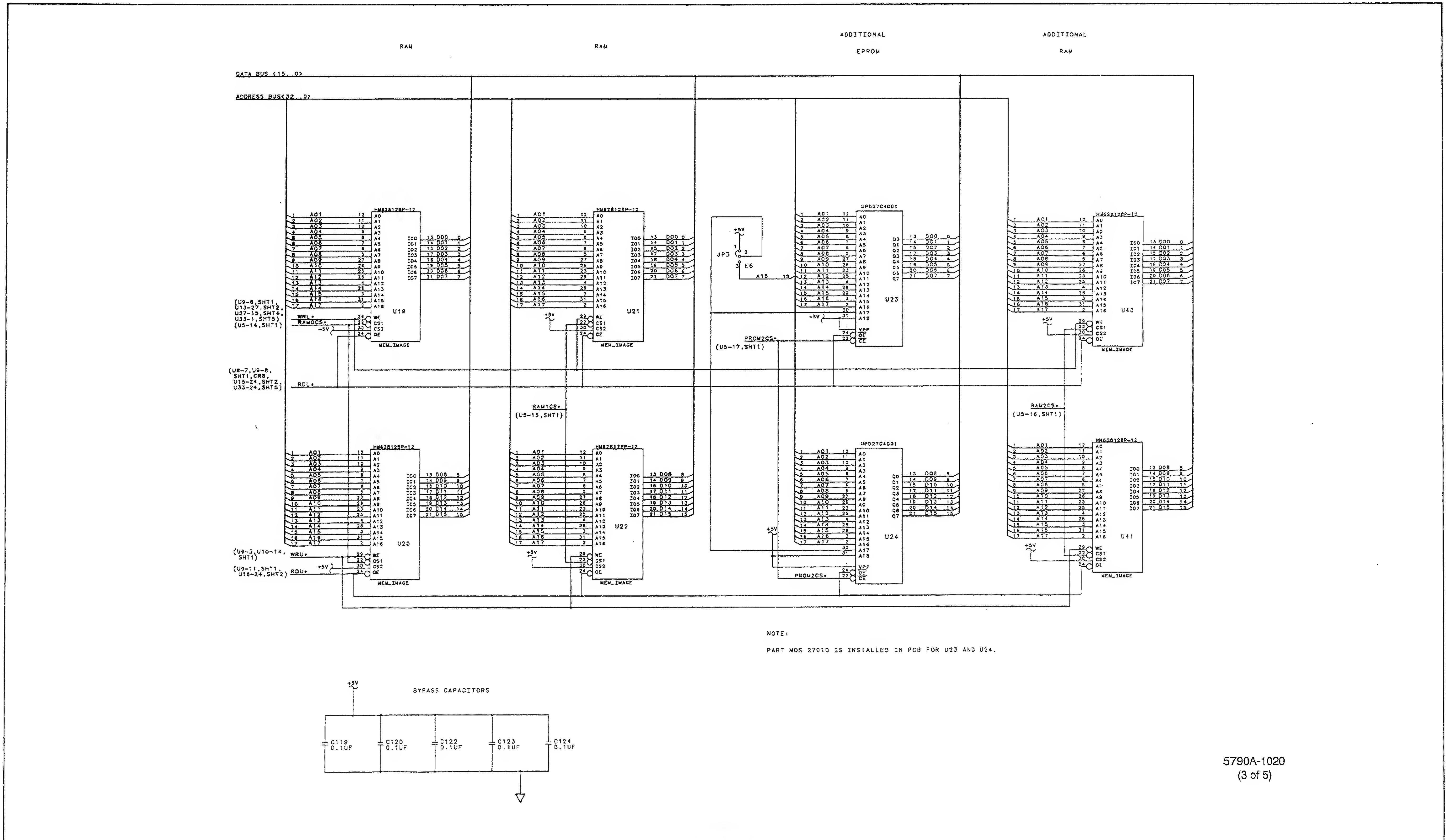
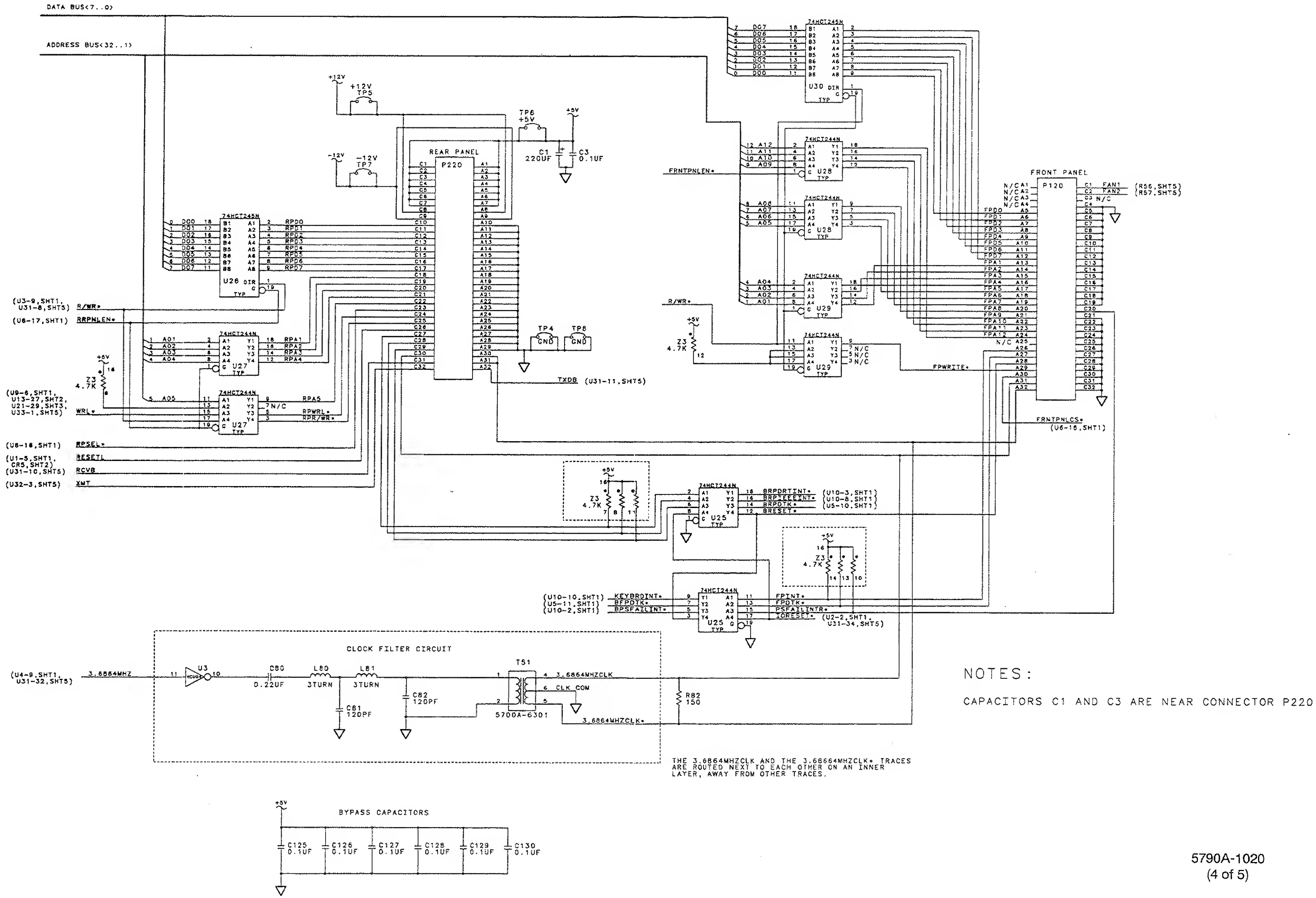


Figure 7-18. A20 CPU PCA (cont)



NOTES:

CAPACITORS C1 AND C3 ARE NEAR CONNECTOR P220.

THE 3.6864MHZCLK AND THE 3.68664MHZCLK* TRACES ARE ROUTED NEXT TO EACH OTHER ON AN INNER LAYER, AWAY FROM OTHER TRACES.

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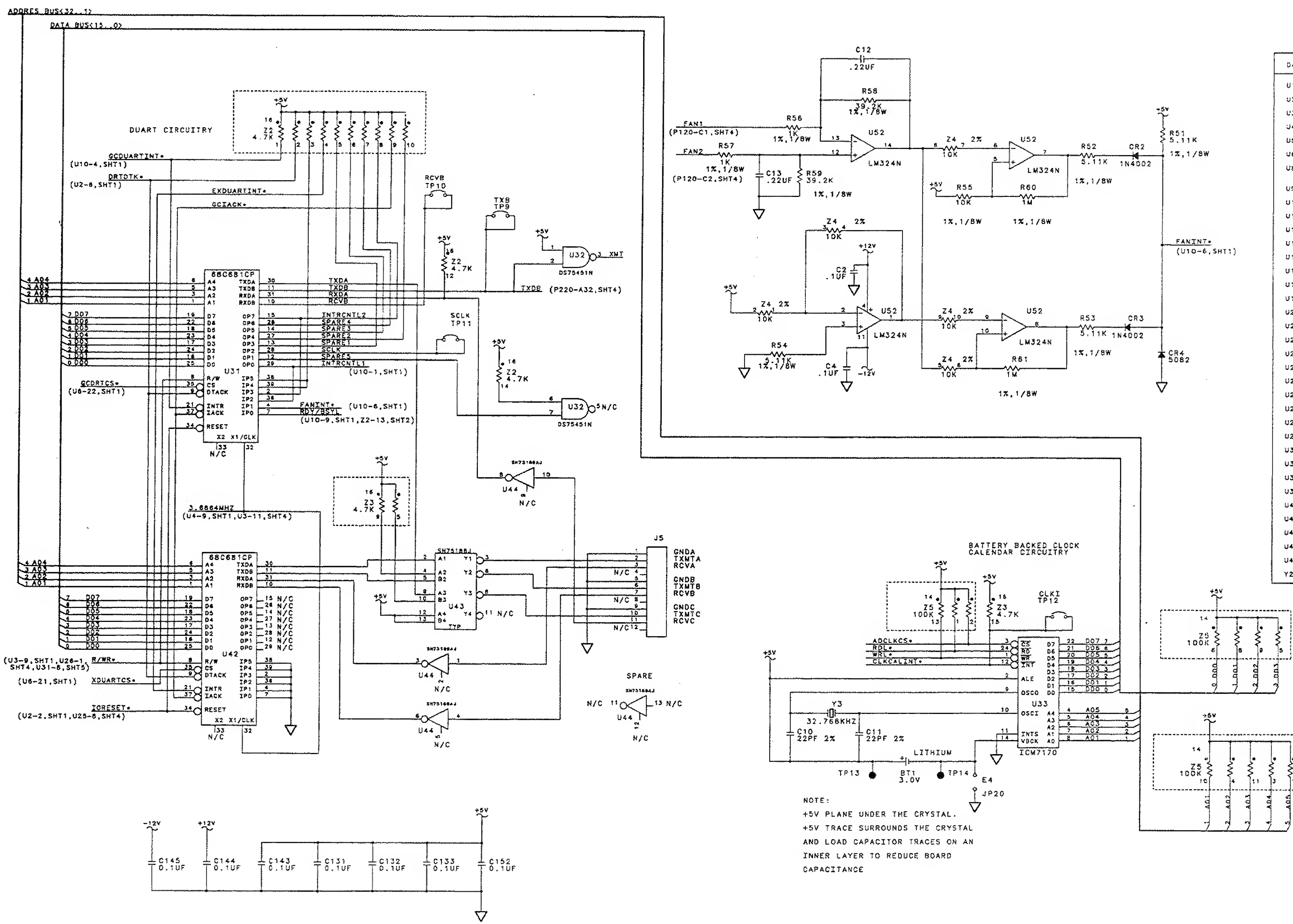
(4 of 5)

Figure 7-18. A20 CPU PCA (cont)



Designator	GND	-12V	+12V	+5V
U1	4			8
U2	7			14
U3	7			14
U4	8			16
U5	12			24
U6	12			24
U8	16 53			14 49
U9	7			14
U10	12			24
U11	8			16
U13	14			28
U15	16			32
U16	16			32
U17	16			32
U18	16			32
U19	16			32
U20	16			32
U21	16			32
U22	16			32
U23	16			32
U24	16			32
U25	10			20
U26	10			20
U27	10			20
U28	10			20
U29	10			20
U30	10			20
U31	20			40
U32	4			8
U33	13			23
U40	16			32
U41	16			32
U42	20			40
U43	7	1	14	
U44	7			14
Y2	7			14

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Figure 7-18. A20 CPU PCA (cont)

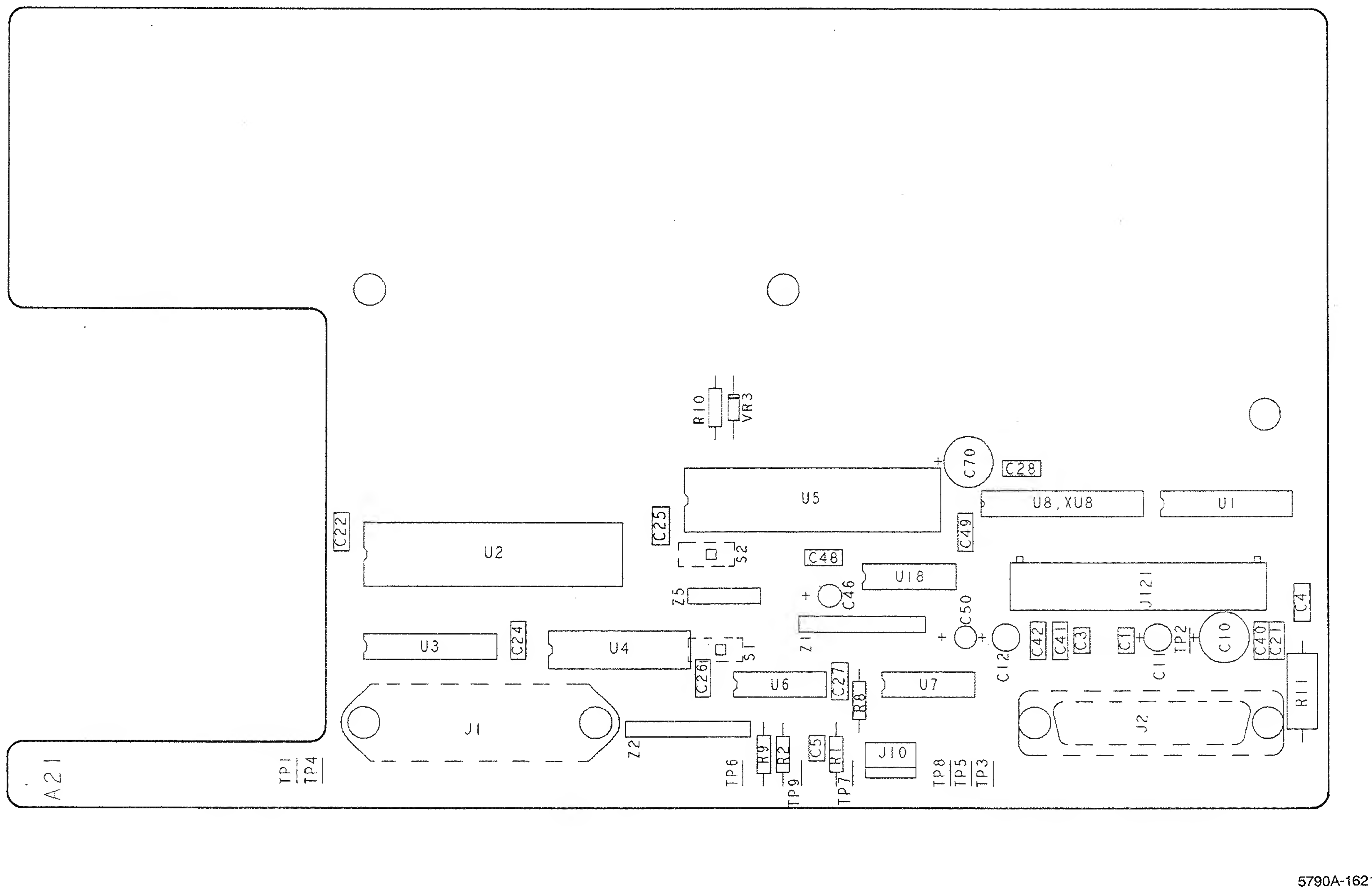


Figure 7-19. A21 Rear Panel I/O PCA

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE IN OHMS.
   ALL CAPACITOR VALUES ARE IN MICROFARADS.

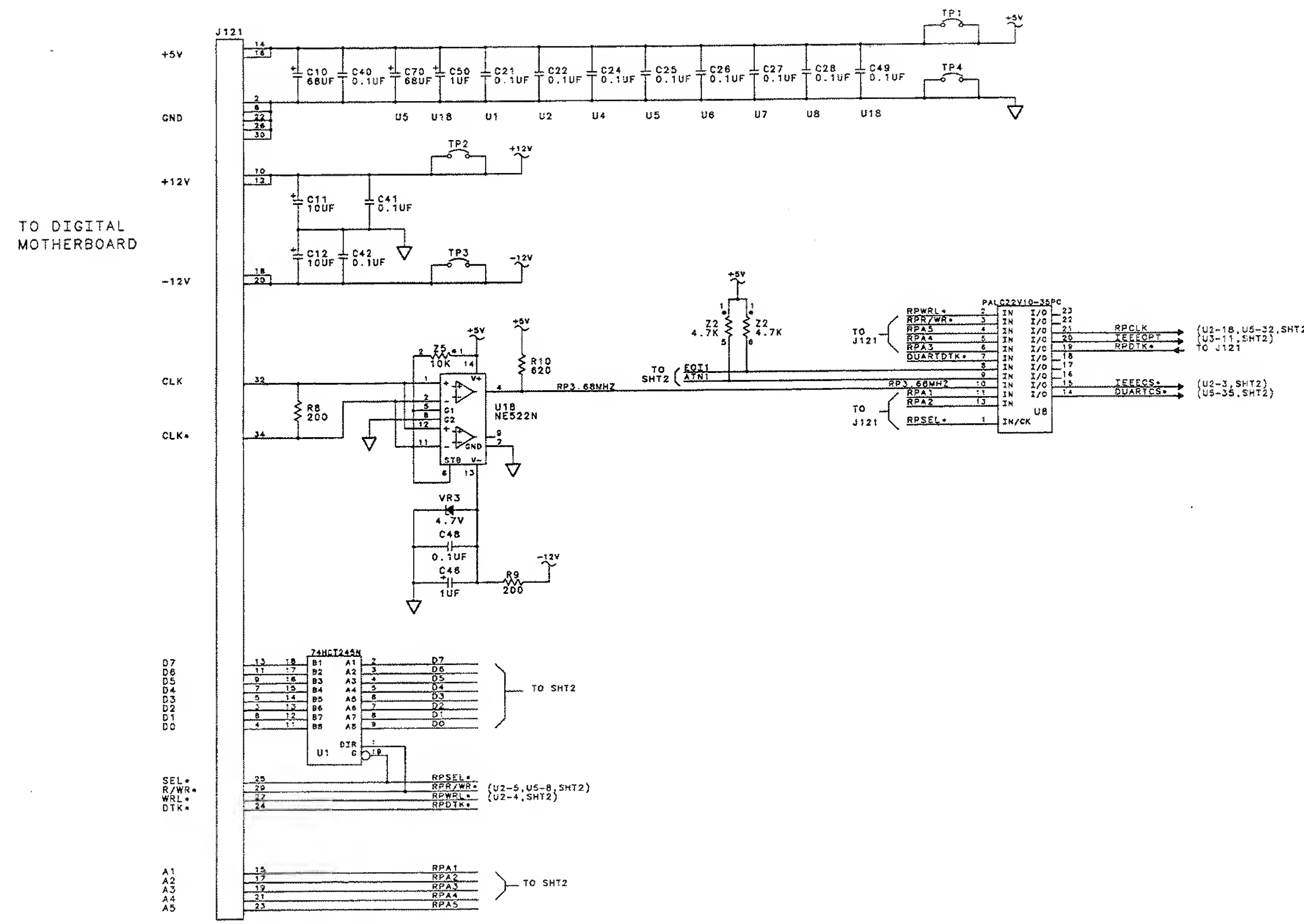
2.

3.

4. THE MOUNTING HOLE FOR CONNECTORS J1 AND J2
   ARE TIED TO CHASSIS THROUGH LAND PATTERNS ON THE PWB.

TESTPOINTS		
TP1	+5V	PG 1
TP2	+12V	PG 1
TP3	-12V	PG 1
TP4	GND	PG 1
TP5	-RXDA	PG 2
TP6	-TXDA	PG 2
TP7	SERIAL CLOCK	PG 2
TP8	-RXDB	PG 2
TP9	-TXDB	PG 2

Designator	GND	-12V	+12V	+5V
U1	10			20
U2	20			40
U3	10			20
U4	11			22
U5	20			40
U6	7	1	14	
U7	7			14
U8	12			24



5790A-1021
(1 of 2)

Figure 7-19. A21 Rear Panel I/O PCA (cont)

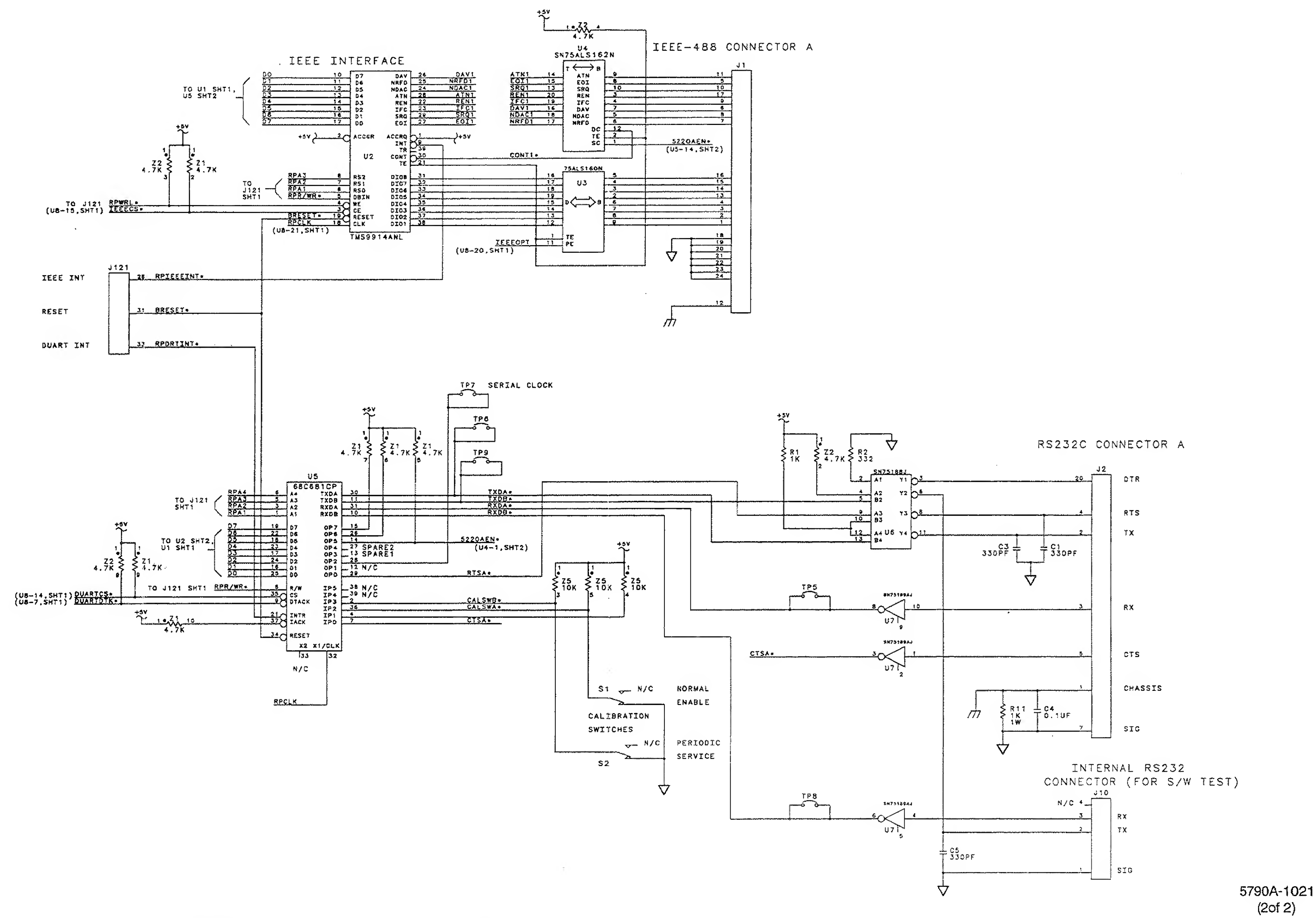
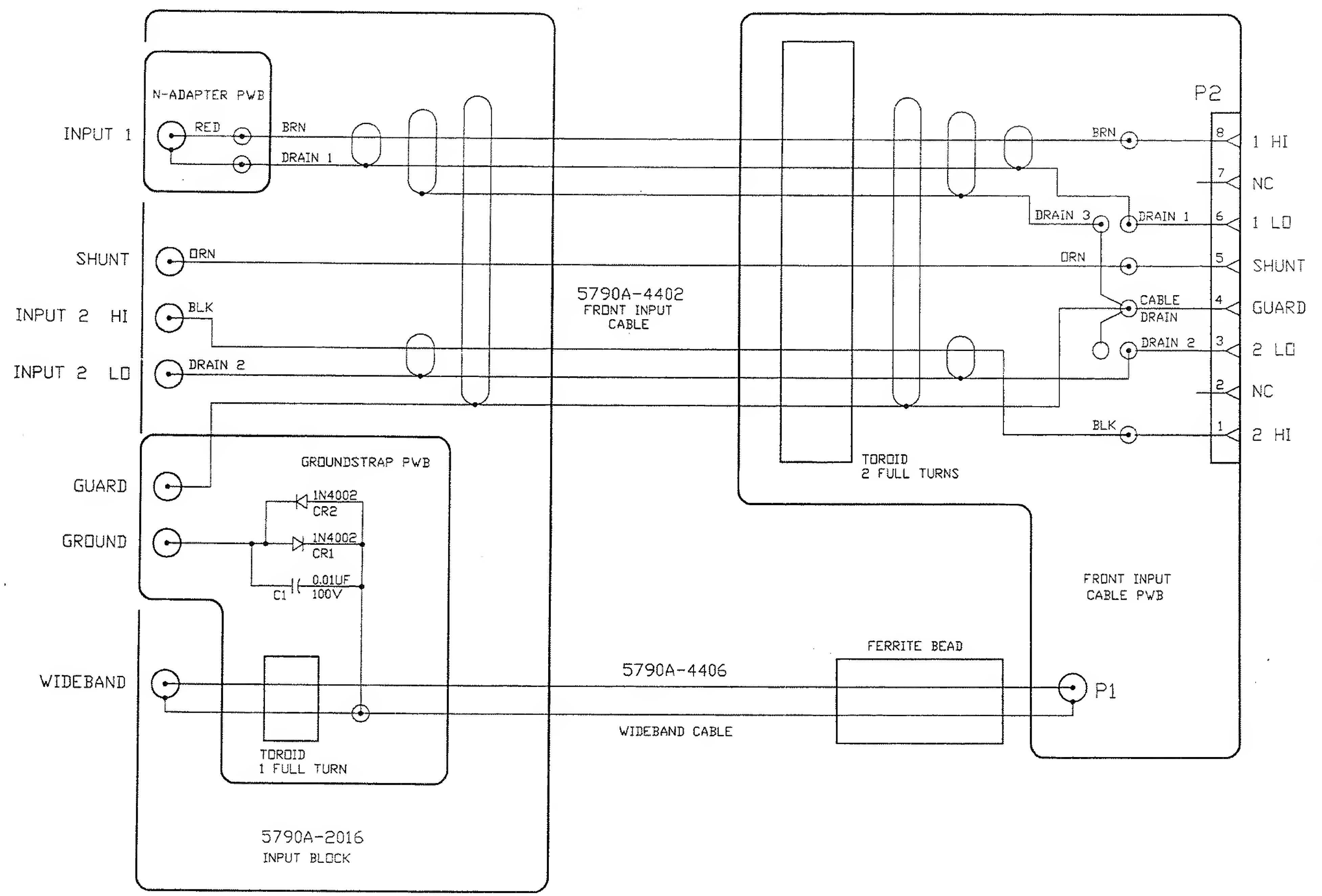


Figure 7-19. A21 Rear Panel I/O PCA (cont)



NOTES: (UNLESS OTHERWISE SPECIFIED)

1.

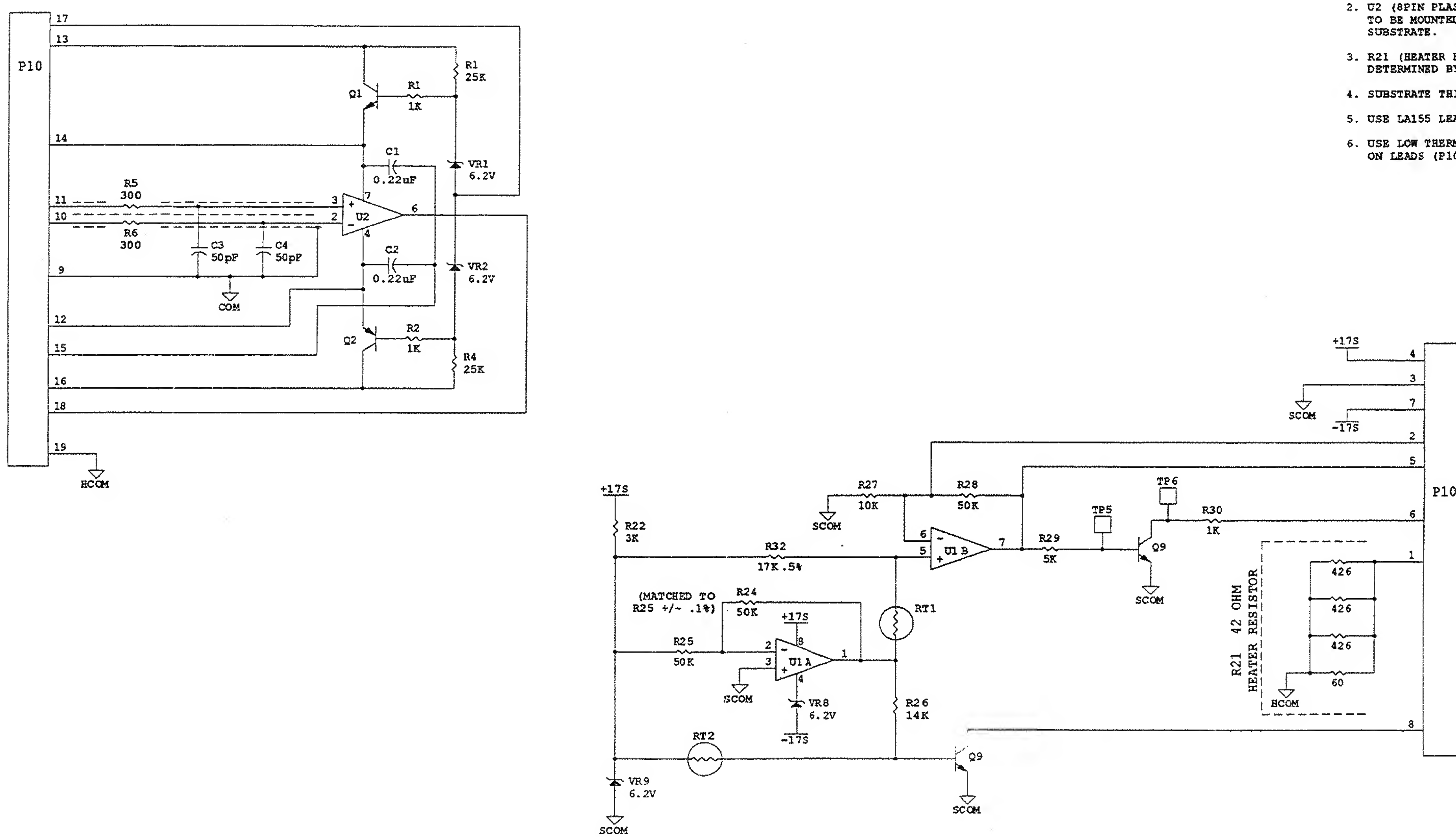
2. ALL RESISTORS ARE IN OHMS
ALL CAPACITOR VALUES ARE IN MICROFARADS

5790A-1022

Figure 7-20. A62 Input Block Assembly

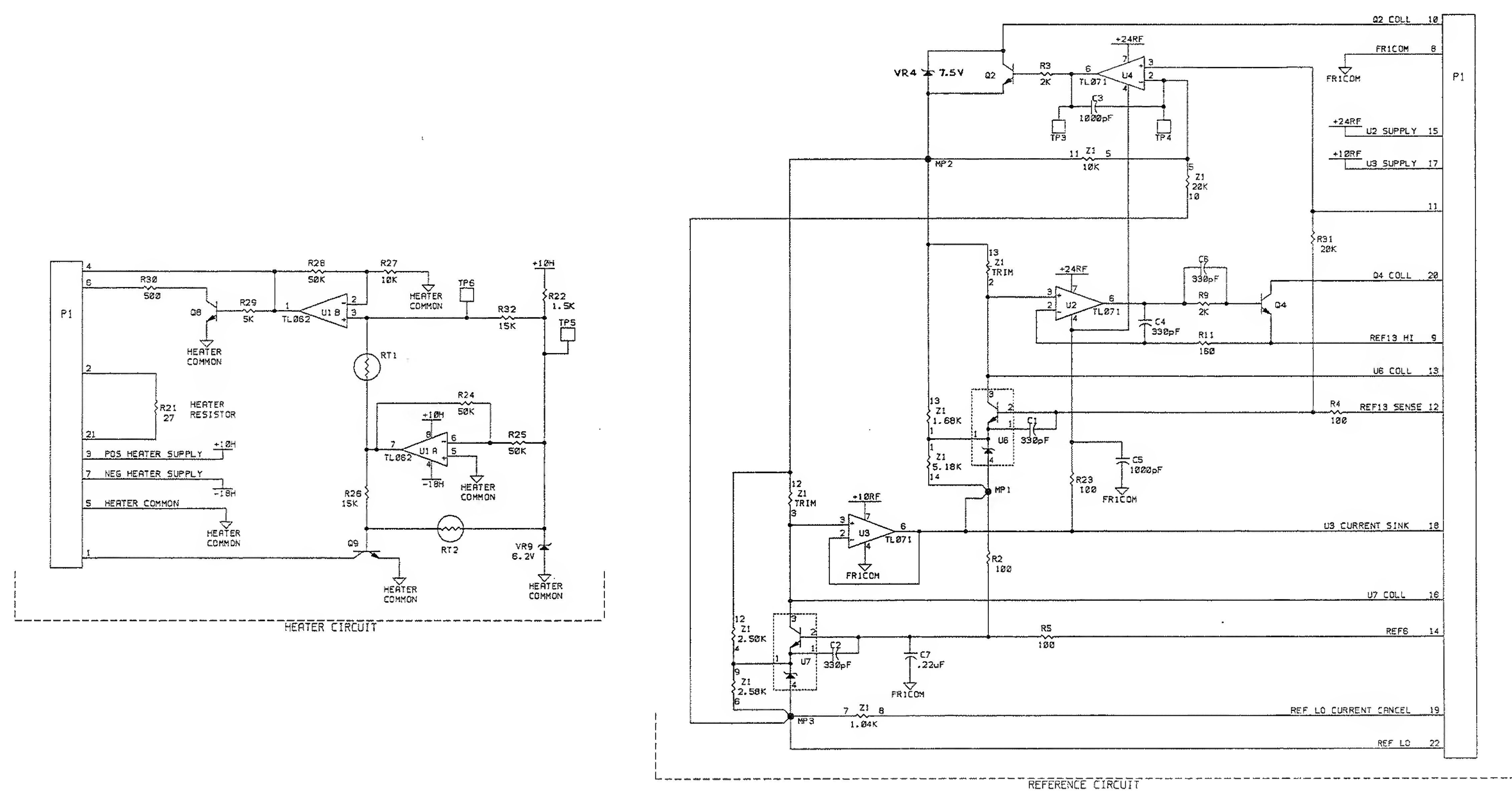
NOTES (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTOR VALUES ARE IN OHMS, 5%.
2. U2 (8PIN PLASTIC DIP PACKAGE) TO BE MOUNTED FLUSH TO SUBSTRATE.
3. R21 (HEATER RESISTOR) IS DETERMINED BY EXTERNAL JUMPERS.
4. SUBSTRATE THICKNESS = 25 MIL.
5. USE LA155 LEADS (513622)
6. USE LOW THERMAL MATERIAL ON LEADS (P10 - PINS 10 & 11).



5700A-1H01

Figure 7-21. A16HR6 DC Amp Hybrid (on the A16 Dac PCA)



5700A-1H42

Figure 7-22. A16HR9 Reference Hybrid
(on the A16 Dac PCA)

Appendices

CONTENTS

Appendix A
Glossary of AC-DC Transfer Related Terms

absolute uncertainty

Uncertainty that includes contributions from all sources, i.e., traceability to national standards of the standards used, plus the uncertainty of the measurement process. Absolute uncertainty should be used to compute test uncertainty ratio. Also see "relative uncertainty".

accuracy

The degree to which the measured value of a quantity agrees with the accepted, consensus, or true value of that quantity. Accuracy is the same as 1 - % uncertainty. For example, an instrument specified to ±1% uncertainty is 99% accurate. Also see "uncertainty".

artifact calibration

An instrument calibration technique that uses a calibration system within the instrument to reduce the number of required external standards to a small number of artifact standards. The Fluke 5700A Calibrator uses Artifact Calibration.

artifact standard

A stable object that produces or embodies a physical quantity for use as a reference standard. An artifact standard may have an assigned traceable value when used for calibration purposes. Fluke 732A DC Voltage Reference Standard and the Fluke 742A Series Standard Resistors are examples. Also see "transfer standard".

ac-dc absolute uncertainty

Includes all known error sources contributing to the uncertainty of an ac-dc difference correction. This includes NIST (National Institute of Standards and Technology) uncertainties, transfer uncertainty from a primary standard to a working standard, and internal error contributions (both random and temperature related).

ac-dc transfer

The process of comparing an ac voltage to a known dc voltage, thereby transferring the low uncertainty of the dc voltage to the ac voltage. The 792A can be used to perform two different types of ac-dc transfers:

1. An ac measurement
2. An ac-dc difference measurement

In an ac measurement, the transfer standard is used to determine absolute rms ac voltage level. In an ac-dc difference measurement, the transfer standard is a reference that tests the ac and dc response of another transfer standard. The goal of an ac measurement is to determine the error of the ac source or ac voltmeter under test. The goal of an ac-dc difference measurement is a value called the "ac-dc difference," which is positive when

more ac voltage than dc voltage is required to produce the same output in the transfer standard under test.

ac-dc difference

A measurement of an ac-dc transfer device's accuracy. The ac-dc difference is a transfer device's error when it compares a dc voltage to the same ac rms voltage. A positive ac-dc difference indicates that more alternating than direct voltage is required to produce the same reading.

base units

Units in the SI system that are dimensionally independent. All other units are derived from base units. The only base unit in electricity is the ampere.

buffer

1. An area of digital memory for temporary storage of data. 2. An additional amplifier stage to reduce output impedance levels.

burden voltage

The maximum sustainable voltage across the terminals of a load.

calibration

The comparison of a measurement system or device of unknown accuracy to a measurement system or device of known and greater accuracy to detect or correct any variation from required performance of the unverified measurement system or device. Also see "verification" and "traceability".

calibration constant

A coefficient that is applied manually or automatically to adjust the output or reading of an instrument.

calibration curve

A smooth curve drawn through a graph of calibration points.

calibration interval

The interval after which calibration must occur to maintain the performance of an instrument as stated in its specifications.

calibration report

A record of shifts or calibration constant changes that have occurred during calibration.

calibrator

A device that supplies outputs with a known uncertainty for use in testing the accuracy of measurement devices or other sources.

characterization

A calibration process that produces a calibration constant or known error for use in correcting the output or reading of an instrument or standard.

common mode noise

An undesired signal that exists between a device's terminals and ground. Common mode noise is at the same potential on both terminals of a device. Also see "normal mode noise".

compliance voltage

The maximum voltage that a constant-current source can supply.

confidence level

A percentage indicating certainty or assurance that an associated condition is true.

control chart

A chart devised to monitor one or more processes in order to detect the excessive deviation from a desired value of a component or process.

crest factor

The ratio of the peak voltage to the rms voltage of a waveform (with the dc component removed). Also see rms.

dac (digital-to-analog converter)

A device or circuit that converts a digital waveform to an analog voltage.

derived units

Units in the SI system that are derived from base units. Volts, ohms, and watts are derived from amperes and other base and derived units.

distribution function

The expression of a relationship between the values and the corresponding frequencies of a variable.

drift

Gradual change in a value over time.

error

Deviation from correct value. The different types of error defined in this glossary are floor, gain, offset, linearity, random, scale, systematic, transfer, and zero.

flatness

flatness

A measure of output level variation for an ac voltage source as frequency is varied. Flatness limits are normally specified as a ratio (%) to nominal output level at a reference frequency.

floor error

A contribution to measurement or source uncertainty that is independent of reading or output setting. In uncertainty specifications, floor error is often combined with fixed range errors and expressed in units such as microvolts or counts of the least significant digit. Also see “error”.

full scale

The upper limit of measurement or source value for which a given uncertainty specification applies, including any “overrange”. Also see “overrange” and “range”.

gain error

Same as scale error. An example of scale or gain error is when the slope of a calibrator's displayed output vs. its true output is not exactly 1. A calibrator with only gain error (no offset or linearity error), will read 0V with 0V on the display, but something other than 10V with 10V on the display.

ground

The voltage reference point in a circuit. Earth ground is a connection through a ground rod or other conductor to the earth, usually accessible through the ground conductor in an ac power receptacle.

ground loop

Undesirable current induced when there is more than one chassis ground potential in a system of instruments. Ground loops can be minimized by connecting all instruments in a system to ground at one point.

guard

A floating shield around sensitive circuitry inside an instrument. The guard provides a low-impedance path to ground for common-mode noise and ground currents, thereby eliminating errors introduced by such interference.

International System of Units

Same as "SI System of Units"; the accepted system of units. See also "units," "base units," and "derived units."

legal units

The highest echelon in a system of units, for example the 1990 SI volt.

life-cycle cost

The consideration of all elements contributing to the cost of an instrument throughout its useful life. This includes initial purchase cost, service and maintenance cost, and the cost of support equipment.

linearity

The relationship between two quantities when a change in the first quantity is directly proportional to a change in the second quantity.

linearity error

Linearity error occurs when the true output vs. selected output response curve of a calibrator is not exactly a straight line. You can measure this type of error by plotting the response curve, then measuring how far the curve deviates from the straight line at various points.

MAP (Measurement Assurance Program)

A program for a measurement process. A MAP provides information to demonstrate that the total uncertainty of the measurements (data), including both random error and systematic components of error relative to national or other designated standards is quantified, and sufficiently small to meet requirements.

maximum transfer time

Maximum time that an ac-dc transfer can be made to stay within the stated ac-dc absolute uncertainty.

metrology

The science of, and the field of knowledge concerned with measurement.

minimum V(sub)in

For each range of an ac/ac transfer standard, the minimum input rms voltage for which uncertainty specifications apply. Also see rms.

metrology

The science of, and the field of knowledge concerned with measurement.

minimum use specifications

Specifications computed to satisfy the calibration requirements of measurement or source device (UUT). Usually determined by a specified test uncertainty ratio between the absolute uncertainties of the UUT and its required calibration equipment. Also see Test Uncertainty Ratio.

noise

An undesirable signal that is superimposed on a desired or expected signal. See "normal mode noise" and "common mode noise".

noise floor

For an ac-dc transfer standard, the transfer uncertainty due to noise factors.

nonvolatile memory

An electronic memory that retains its contents when power is turned off.

normal mode noise

An undesired signal that appears between the terminals of a device.

offset error

Same as zero error. The reading shown on a meter when an input value of zero is applied is its offset or zero error.

parameters

Independent variables in a measurement process such as temperature, humidity, test lead resistance, etc.

precision

The degree of agreement among independent measurements of a quantity under specified conditions. The precision of a measurement process is its coherence or repeatability. Note that while precision is necessary for accuracy, it does not imply it.

predictability

A measure of what is known of the time-behavior of a device. A documented drift rate with understood characteristics (e.g., linear, exponential) can be highly predictable.

primary standard

A standard defined and maintained by some authority and used to calibrate all other secondary standards.

process metrology

Tracking the accuracy drift of calibration and other equipment by applying statistical analysis to correction factors obtained during calibration.

random error

Any error which varies in an unpredictable manner in absolute value and in sign when measurements of the same value of a quantity are made under effectively identical conditions.

range

Stated upper limits of measurement or source values for which given uncertainty specifications apply. Also see “overrange” and “scale”.

reference standard

The highest-echelon standard in a laboratory; the standard that is used to maintain working standards that are used in routine calibration and comparison procedures.

relative uncertainty

Uncertainty specifications that are relative to a reference value, and not traceable to national standards. Also see “absolute uncertainty”.

reliability

A measure of the probability of failure of an instrument.

repeatability

See “precision”.

resistance

A property of a conductor that determines the amount of current that will flow when a given amount of voltage exists across the conductor. Resistance is measured in ohms. One ohm is the resistance through which one volt of potential will cause one ampere of current to flow.

resolution

The smallest change in quantity that can be detected by a measurement system or device. For a given parameter, resolution is the smallest increment that can be measured, generated or displayed.

reversal error

Also called turnover error, the difference in output of an ac-dc transfer standard for the same dc input but with polarity reversed. The output logged for the dc reference should be the average of the two readings.

retrace error

For an ac-dc transfer standard, the degree of agreement of output value readings when input is applied, removed, and reapplied over a specified time period.

rf (radio frequency)

The frequency range of radio waves; from 150 kHz up to the infrared range.

rms (root-mean-square)

The value assigned to an ac voltage or current that results in the same power dissipation in a resistance as a dc current or voltage of the same value.

rms sensor

A device that generates a dc output signal proportional to the rms value of the input signal. RMS sensors operate by measuring the heat generated by a voltage through a known resistance (i.e., power); therefore, they sense true rms voltage. RMS sensors are used to make ac-dc difference measurements.

scale

The absolute span of the reading range of a measurement device including overrange capability.

scale error

See “gain error”.

secondary standard

A standard maintained by comparison against a primary standard.

sensitivity

The degree of response of a measuring device to the change in input quantity, or a figure of merit that expresses the ability of a measurement system or device to respond to an input quantity.

settling time

The time it takes for a measurement device’s reading to stabilize after a voltage is applied to the input.

shield

A grounded covering device designed to protect a circuit or cable from electromagnetic interference. Also see “guard”.

SI System of Units

The accepted International System of Units. See also “units,” “base units,” and “derived units.”

specifications

A precise statement of the performance of a measurement or stimulus device.

square law

Defines the response of a device whose output is proportional to the square of the applied stimulus. Thermocouple-type transfer devices have a square-law response.

stability

A measure of the freedom from drift relative to a reference value, over time and over changes in other variables such as temperature. Note that stability is not the same as uncertainty.

standard

A device that is used as an exact value for reference and comparison.

standard cell

A primary cell that serves as a standard of voltage. The term “standard cell” often refers to a “Weston normal cell”, which is a wet cell with a mercury anode, a cadmium mercury amalgam cathode, and a cadmium sulfate solution as the electrolyte.

systematic error

Any error that remains constant or varies in a predictable manner as successive measurements of the same quantity are made under effectively identical conditions. Note that a known systematic error can be compensated for with a correction, whereas a random error cannot. Also see “random error”.

temperature coefficient

A factor used to calculate the change in indication or output of an instrument as a result of changes in temperature. Changes in temperature contribute to instrument uncertainty by an amount determined by the temperature coefficient.

test uncertainty ratio

The numerical ratio of the uncertainty of the measurement system or device being calibrated or verified, and the uncertainty of the measurement system or reference device.

thermal emf

The voltage generated when two dissimilar metals joined together are heated.

traceability

The ability to relate individual measurement results to legally defined national standards through an unbroken chain of comparisons. Traceability requires evidence produced on a continuing basis, such as calibration records, that the measurement process is producing results for which the total measurement uncertainty relative to national standards is quantified.

transfer

See “ac-dc transfer.”

transfer error

Error induced by the process of comparing one standard or instrument with another. This does not include the uncertainty of the transfer standard.

transfer stability

Change in the ac-dc difference correction over time, with stated conditions.

transfer standard

Any standard used to intercompare one measurement or source device with another. Note that a transfer standard needs only to be stable for the duration of the transfer. It does not need an assigned value.

transport standard

A transfer standard that is rugged enough to allow shipment by common carrier to another location.

true value

Also called legal value, the accepted consensus, i.e., the correct value of the quantity being measured.

uncertainty

The range of values, usually centered on the indicated or requested value, within which the true, accepted, or consensus value is expected to lie with stated probability or confidence. Fluke uses 99.7% (3σ) confidence limits. Uncertainty is a quantification of inaccuracy.

units

Symbols or names that define the measured quantities. Examples of units are: V, mV, A, kW, and dBm. See also "SI System of Units."

UUT (Unit Under Test)

An abbreviated name for an instrument that is being tested or calibrated.

volt

The unit of emf (electromotive force) or electrical potential in the SI system of units. One volt is the difference of electrical potential between two points on a conductor carrying one ampere of current, when the power being dissipated between these two points is equal to one watt.

The unit of power in the SI system of units. One watt is the power required to do work at the rate of one joule/second. In terms of volts and ohms, one watt is the power dissipated by one ampere flowing through a one-ohm load.

In instrumentation, wideband refers to the ability to measure or generate signals in the radio frequency spectrum.

verification

The comparison of a measurement or source device (UUT) with a measurement or source device of known and lesser uncertainty, to report variation from required performance. Verification does not include adjustment or reassignment of values to UUT, and is often done to determine whether adjustment is necessary. Also see "calibration".

working standard

A standard that is used in routine calibration and comparison procedures in the laboratory, and is maintained by comparison to reference standards.

zero error

Same as offset error. The reading shown on a meter when an input value of zero is applied is its zero or offset error.

Appendix B
ASCII and IEEE-488 Bus Codes

ASCII CHAR.	DECIMAL	OCTAL	HEX	BINARY 7654 3210	DEV. NO.	MESSAGE ATN=TRUE	
NUL	0	000	00	0000 0000			ADDRESSED COMMANDS
SOH	1	001	01	0000 0001		GTL	
STX	2	002	02	0000 0010			
ETX	3	003	03	0000 0011			
EOT	4	004	04	0000 0100		SDC	
ENQ	5	005	05	0000 0101		PPC	
ACK	6	006	06	0000 0110			
BELL	7	007	07	0000 0111			
BS	8	010	08	0000 1000		GET	
HT	9	011	09	0000 1001		TCT	
LF	10	012	0A	0000 1010			
VT	11	013	0B	0000 1011			
FF	12	014	0C	0000 1100			
CR	13	015	0D	0000 1101			
SO	14	016	0E	0000 1110			
SI	15	017	0F	0000 1111			
DLE	16	020	10	0001 0000			UNIVERSAL COMMANDS
DC1	17	021	11	0001 0001		LLO	
DC2	18	022	12	0001 0010			
DC3	19	023	13	0001 0011			
DC4	20	024	14	0001 0100		DCL	
NAK	21	025	15	0001 0101		PPU	
SYN	22	026	16	0001 0110			
ETB	23	027	17	0001 0111			
CAN	24	030	18	0001 1000		SPE	
EM	25	031	19	0001 1001		SPD	
SUB	26	032	1A	0001 1010			
ESC	27	033	1B	0001 1011			
FS	28	034	1C	0001 1100			
GS	29	035	1D	0001 1101			
RS	30	036	1E	0001 1110			
US	31	037	1F	0001 1111			
SPACE	32	040	20	0010 0000	0	MLA	LISTEN ADDRESSES
!	33	041	21	0010 0001	1	MLA	
"	34	042	22	0010 0010	2	MLA	
#	35	043	23	0010 0011	3	MLA	
$	36	044	24	0010 0100	4	MLA	
%	37	045	25	0010 0101	5	MLA	
&	38	046	26	0010 0110	6	MLA	
'	39	047	27	0010 0111	7	MLA	
(	40	050	28	0010 1000	8	MLA	
)	41	051	29	0010 1001	9	MLA	
*	42	052	2A	0010 1010	10	MLA	
+	43	053	2B	0010 1011	11	MLA	
,	44	054	2C	0010 1100	12	MLA	
-	45	055	2D	0010 1101	13	MLA	
.	46	056	2E	0010 1110	14	MLA	
/	47	057	2F	0010 1111	15	MLA	
0	48	060	30	0011 0000	16	MLA	
1	49	061	31	0011 0001	17	MLA	
2	50	062	32	0011 0010	18	MLA	
3	51	063	33	0011 0011	19	MLA	
4	52	064	34	0011 0100	20	MLA	
5	53	065	35	0011 0101	21	MLA	
6	54	066	36	0011 0110	22	MLA	
7	55	067	37	0011 0111	23	MLA	
8	56	070	38	0011 1000	24	MLA	
9	57	071	39	0011 1001	25	MLA	
:	58	072	3A	0011 1010	26	MLA	
;	59	073	3B	0011 1011	27	MLA	
<	60	074	3C	0011 1100	28	MLA	
=	61	075	3D	0011 1101	29	MLA	
>	62	076	3E	0011 1110	30	MLA	
?	63	077	3F	0011 1111		UNL	

ASCII CHAR.	DECIMAL	OCTAL	HEX	BINARY 7654 3210	DEV. NO.	MESSAGE ATN=TRUE	
@	64	100	40	0100 0000	0	MTA	TALK ADDRESSES
A	65	101	41	0100 0001	1	MTA	
B	66	102	42	0100 0010	2	MTA	
C	67	103	43	0100 0011	3	MTA	
D	68	104	44	0100 0100	4	MTA	
E	69	105	45	0100 0101	5	MTA	
F	70	106	46	0100 0110	6	MTA	
G	71	107	47	0100 0111	7	MTA	
H	72	110	48	0100 1000	8	MTA	
I	73	111	49	0100 1001	9	MTA	
J	74	112	4A	0100 1010	10	MTA	
K	75	113	4B	0100 1011	11	MTA	
L	76	114	4C	0100 1100	12	MTA	
M	77	115	4D	0100 1101	13	MTA	
N	78	116	4E	0100 1110	14	MTA	
O	79	117	4F	0100 1111	15	MTA	
P	80	120	50	0101 0000	16	MTA	
Q	81	121	51	0101 0001	17	MTA	
R	82	122	52	0101 0010	18	MTA	
S	83	123	53	0101 0011	19	MTA	
T	84	124	54	0101 0100	20	MTA	
U	85	125	55	0101 0101	21	MTA	
V	86	126	56	0101 0110	22	MTA	
W	87	127	57	0101 0111	23	MTA	
X	88	130	58	0101 1000	24	MTA	
Y	89	131	59	0101 1001	25	MTA	
Z	90	132	5A	0101 1010	26	MTA	
[	91	133	5B	0101 1011	27	MTA	
\	92	134	5C	0101 1100	28	MTA	
]	93	135	5D	0101 1101	29	MTA	
^	94	136	5E	0101 1110	30	MTA	
_	95	137	5F	0101 1111		UNT	
`	96	140	60	0110 0000	0	MSA	SECONDARY ADDRESSES
a	97	141	61	0110 0001	1	MSA	
b	98	142	62	0110 0010	2	MSA	
c	99	143	63	0110 0011	3	MSA	
d	100	144	64	0110 0100	4	MSA	
e	101	145	65	0110 0101	5	MSA	
f	102	146	66	0110 0110	6	MSA	
g	103	147	67	0110 0111	7	MSA	
h	104	150	68	0110 1000	8	MSA	
i	105	151	69	0110 1001	9	MSA	
j	106	152	6A	0110 1010	10	MSA	
k	107	153	6B	0110 1011	11	MSA	
l	108	154	6C	0110 1100	12	MSA	
m	109	155	6D	0110 1101	13	MSA	
n	110	156	6E	0110 1110	14	MSA	
o	111	157	6F	0110 1111	15	MSA	
p	112	160	70	0111 0000	16	MSA	
q	113	161	71	0111 0001	17	MSA	
r	114	162	72	0111 0010	18	MSA	
s	115	163	73	0111 0011	19	MSA	
t	116	164	74	0111 0100	20	MSA	
u	117	165	75	0111 0101	21	MSA	
v	118	166	76	0111 0110	22	MSA	
w	119	167	77	0111 0111	23	MSA	
x	120	170	78	0111 1000	24	MSA	
y	121	171	79	0111 1001	25	MSA	
z	122	172	7A	0111 1010	26	MSA	
{	123	173	7B	0111 1011	27	MSA	
|	124	174	7C	0111 1100	28	MSA	
}	125	175	7D	0111 1101	29	MSA	
~	126	176	7E	0111 1110	30	MSA	
	127	177	7F	0111 1111			

Appendix C
Calibration Constant Information

The constants in these tables are arranged by group. Each group is stored as a block in nonvolatile memory. The value given for each constant in this list is the default assigned before the instrument is first calibrated. Defaults are reinstated if you perform a format of the EEPROM ALL or CAL areas.

NOTE

Refer to Section 2 of the 5790A Service Manual for calibration constant theory of operation.

Group ZC_BASIC: Internally Calibrated DAC, Sensor, and A/D Parameters

NAME	DEFAULT	FUNCTION
DAC_Z1	398.0	Reference DAC zero, coarse channel
DAC_Z2	17500.0	Reference DAC zero, fine channel
DAC_RATIO	16500.0	Reference DAC coarse/fine gain ratio
AD_X1_Z	0.0	A/D x1 range zero
AD_X1_G	-7.23E-6	A/D x1 range gain
AD_X10_Z	0.0	A/D x100 range zero
AD_X10_G	7.23E-8	A/D x100 range gain
NULLDAC_Z	0.0	Null DAC zero
NULLDAC_G	6560.0	Null DAC gain
SENSOR_C1	1.0	Main thermal sensor linearization
SENSOR_C2	0.0	Main thermal sensor linearization
OF_VSQ	0.0	Main thermal sensor turnover correction

Group FREQ: Frequency Counter Gain

NAME	DEFAULT	FUNCTION
FREQ_G	1.0	(see title)

Group DC_DAC: Reference DAC Coarse Channel Gain

NAME	DEFAULT	FUNCTION
DAC_G	3017.0	(see title)

Group WDC_SENSOR: Wideband Sensor Linearization

NAME	DEFAULT	FUNCTION
SENSOR_C1_WB	3.162277660e-03	Wideband thermal sensor linearization
SENSOR_C2_WB	0.0	Wideband thermal sensor linearization

Group AC_LINEARITY: Low Frequency Linearization

NAME	DEFAULT	FUNCTION
LN_C	.02	(see title)

Group FACTORY: Factory/Service Calibrated Corrections

NAME	DEFAULT	FUNCTION
INPUT2_LO	150.0E-6	(INPUT2 vs INPUT1 flatness, <2.2V)
INPUT2_MID	350.0E-6	(INPUT2 vs INPUT1 flatness, 2.2-220V)
INPUT2_HI	-17.0E-6	(INPUT2 vs INPUT1 flatness, >220V)

Group DC_2_2MV: DC Constants, 2.2 mV Range

NAME	DEFAULT	FUNCTION
DI_2_2MV	5000.0	Basic gain (Ref DAC to input ratio)
OF_2_2MV	0.0	Full scale calibrated DC offset

Group ZC_2_2MV: More DC Constants, 2.2 mV Range

NAME	DEFAULT	FUNCTION
Z_2_2MV	0.0	Zero calibrated DC offset
SHO_2_2MV	0.0	Shunt input DC offset
IA_2_2MV	0.001	Rough gain (input to A/D ratio)

Group AC_2_2MV: Flatness Constants, 2.2 mV Range

NAME	DEFAULT	FUNCTION
F1_2_2MV	1.0	(10 Hz)
F2_2_2MV	1.0	(1 kHz)
F3_2_2MV	1.0	(20 kHz)
F4_2_2MV	1.0	(300 kHz)
F5_2_2MV	1.0	(500 kHz)
F6_2_2MV	1.0	(800 kHz)
F7_2_2MV	1.0	(1 MHz)

Group DC_7MV: DC Constants, 7 mV Range

NAME	DEFAULT	FUNCTION
DI_7MV	1000.0	Basic gain (Ref DAC to input ratio)
OF_7MV	0.0	Full scale calibrated DC offset

Group ZC_7MV: More DC Constants, 7 mV Range

NAME	DEFAULT	FUNCTION
Z_7MV	0.0	Zero calibrated DC offset
SHO_7MV	0.0	Shunt input DC offset
IA_7MV	0.00316228	Rough gain (input to A/D ratio)

Group AC_7MV: Flatness Constants, 7 mV Range

NAME	DEFAULT	FUNCTION
F1_7MV	1.0	(10 Hz)
F2_7MV	1.0	(1 kHz)
F3_7MV	1.0	(20 kHz)
F4_7MV	1.0	(300 kHz)
F5_7MV	1.0	(500 kHz)
F6_7MV	1.0	(800 kHz)
F7_7MV	1.0	(1 MHz)

Group DC_22MV: DC Constants, 22 mV RANGE

NAME	DEFAULT	FUNCTION
DI_22MV	500.0	Basic gain (Ref DAC to input ratio)
OF_22MV	0.0	Full scale calibrated DC offset

Group ZC_22MV: More DC Constants, 22 mV Range

NAME	DEFAULT	FUNCTION
Z_22MV	0.0	Zero calibrated DC offset
SHO_22MV	0.0	Shunt input DC offset
IA_22MV	0.01	Rough gain (input to A/D ratio)

Group AC_22MV Flatness Constants, 22 mV Range

NAME	DEFAULT	FUNCTION
F1_22MV	1.0	(10 Hz)

Group AC_22MV Flatness Constants, 22 mV Range (cont)

NAME	DEFAULT	FUNCTION
F2_22MV	1.0	(1 kHz)
F3_22MV	1.0	(20 kHz)
F4_22MV	1.0	(300 kHz)
F5_22MV	1.0	(500 kHz)
F6_22MV	1.0	(1 MHz)

Group DC_70MV: DC Constants, 70 mV Range

NAME	DEFAULT	FUNCTION
DI_70MV	100.0	Basic gain (Ref DAC to input ratio)
OF_70MV	0.0	Full scale calibrated DC offset

Group ZC_70MV: More DC Constants, 70 mV Range

NAME	DEFAULT	FUNCTION
Z_70MV	0.0	Zero calibrated DC offset
SHO_70MV	0.0	Shunt input DC offset
IA_70MV	0.0316228	Rough gain (input to A/D ratio)

Group AC_70MV: Flatness Constants, 70 mV Range

NAME	DEFAULT	FUNCTION
F1_70MV	1.0	(10 Hz)
F2_70MV	1.0	(1 kHz)
F3_70MV	1.0	(20 kHz)
F4_70MV	1.0	(300 kHz)
F5_70MV	1.0	(1 MHz)

Group DC_220MV: DC Constants, 220 mV Range

NAME	DEFAULT	FUNCTION
DI_220MV	50.0	Basic gain (Ref DAC to input ratio)
OF_220MV	0.0	Full scale calibrated DC offset

Group ZC_220MV: More DC Constants, 220 mV Range

NAME	DEFAULT	FUNCTION
Z_220MV	0.0	Zero calibrated DC offset

Group ZC_220MV: More DC Constants, 220 mV Range (cont)

NAME	DEFAULT	FUNCTION
SHO_220MV	0.0	Shunt input DC offset
IA_220MV	0.1	Rough gain (input to A/D ratio)

Group AC_220MV: Flatness Constants, 220 mV Range

NAME	DEFAULT	FUNCTION
F1_220MV	1.0	(10 Hz)
F2_220MV	1.0	(1 kHz)
F3_220MV	1.0	(20 kHz)
F4_220MV	1.0	(300 kHz)
F5_220MV	1.0	(1 MHz)

Group DC_700MV: DC Constants, 700 mV Range

NAME	DEFAULT	FUNCTION
DI_700MV	10.0	Basic gain (Ref DAC to input ratio)
OF_700MV	0.0	Full scale calibrated DC offset

Group ZC_700MV: More DC Constants, 700 mV Range

NAME	DEFAULT	FUNCTION
Z_700MV	0.0	Zero calibrated DC offset
SHO_700MV	0.0	Shunt input DC offset
IA_700MV	0.316228	Rough gain (input to A/D ratio)

Group AC_700MV: Flatness Constants, 700 mV Range

NAME	DEFAULT	FUNCTION
F1_700MV	1.0	(10 Hz)
F2_700MV	1.0	(1 kHz)
F3_700MV	1.0	(20 kHz)
F4_700MV	1.0	(300 kHz)
F5_700MV	1.0	(1 MHz)

Group DC_2_2V: DC constants, mV Range

NAME	DEFAULT	FUNCTION
DI_2_2V	5.0	Basic gain (Ref DAC to input ratio)

Group DC_2_2V: DC constants, mV Range (cont)

NAME	DEFAULT	FUNCTION
OF_2_2V	0.0	Full scale calibrated DC offset

Group ZC_2_2V: More DC Constants, mV Range

NAME	DEFAULT	FUNCTION
Z_2_2V	0.0	Zero calibrated DC offset
IA_2_2V	1.0	Rough gain (input to A/D ratio)

Group AC_2_2V: Flatness Constants, mV Range

NAME	DEFAULT	FUNCTION
F1_2_2V	1.0	(10 Hz)
F2_2_2V	1.0	(1 kHz)
F3_2_2V	1.0	(20 kHz)
F4_2_2V	1.0	(300 kHz)
F5_2_2V	1.0	(1 MHz)

Group DC_7V: DC Constants, 7V Range

NAME	DEFAULT	FUNCTION
DI_7V	1.0	Basic gain (Ref DAC to input ratio)
OF_7V	0.0	Full scale calibrated DC offset

Group ZC_7V: More DC Constants, 7V Range

NAME	DEFAULT	FUNCTION
Z_7V	0.0	Zero calibrated DC offset
IA_7V	3.16228	Rough gain (input to A/D ratio)

Group AC_7V: Flatness Constants, 7V Range

NAME	DEFAULT	FUNCTION
F1_7V	1.0	(10 Hz)
F2_7V	1.0	(1 kHz)
F3_7V	1.0	(20 kHz)
F4_7V	1.0	(100 kHz)

Group DC_7VHF: DC Constants, High Frequency 7V Range

NAME	DEFAULT	FUNCTION
DI_7VHF	1.0	Basic gain (Ref DAC to input ratio)

Group ZC_7VHF: More DC Constants, High Frequency 7V Range

NAME	DEFAULT	FUNCTION
IA_7VHF	3.16228	Rough gain (input to A/D ratio)

Group AC_7VHF: Flatness Constants, High Frequency 7V Range

NAME	DEFAULT	FUNCTION
F1_7VHF	1.0	(100 kHz)
F2_7VHF	1.0	(300 kHz)
F3_7VHF	1.0	(500 kHz)
F4_7VHF	1.0	(800 kHz)
F5_7VHF	1.0	(1 MHz)

Group DC_22V: DC Constants, 22V Range

NAME	DEFAULT	FUNCTION
DI_22V	0.5	Basic gain (Ref DAC to input ratio)
OF_22V	0.0	Full scale calibrated DC offset

Group ZC_22V: More DC Constants, 22V Range

NAME	DEFAULT	FUNCTION
Z_22V	0.0	Zero calibrated DC offset
IA_22V	10.0	Rough gain (input to A/D ratio)

Group AC_22V: Flatness Constants, 22V Range

NAME	DEFAULT	FUNCTION
F1_22V	1.0	(10 Hz)
F2_22V	1.0	(1 kHz)
F3_22V	1.0	(20 kHz)
F4_22V	1.0	(100 kHz)

Group DC_22VHF: DC Constants, High Frequency 22V Range

NAME	DEFAULT	FUNCTION
DI_22VHF	0.5	Basic gain (Ref DAC to input ratio)

Group ZC_22VHF: More DC Constants, High Frequency 22V Range

NAME	DEFAULT	FUNCTION
IA_22VHF	10.0	Rough gain (input to A/D ratio)

Group AC_22VHF: Flatness Constants, High Frequency 22V Range

NAME	DEFAULT	FUNCTION
F1_22VHF	1.0	(100 kHz)
F2_22VHF	1.0	(300 kHz)
F3_22VHF	1.0	(500 kHz)
F4_22VHF	1.0	(1 MHz)

Group DC_70V: DC Constants, 70V Range

NAME	DEFAULT	FUNCTION
DI_70V	0.1	Basic gain (Ref DAC to input ratio)
OF_70V	0.0	Full scale calibrated DC offset

Group ZC_70V: More DC Constants, 70V Range

NAME	DEFAULT	FUNCTION
Z_70V	0.0	Zero calibrated DC offset
IA_70V	31.6228	Rough gain (input to A/D ratio)

Group AC_70V: Flatness Constants, 70V Range

NAME	DEFAULT	FUNCTION
F1_70V	1.0	(10 Hz)
F2_70V	1.0	(1 kHz)
F3_70V	1.0	(20 kHz)
F4_70V	1.0	(500 kHz)
F5_70V	1.0	(1 MHz)

Group DC_220V: DC Constants, 220V Range

NAME	DEFAULT	FUNCTION
DI_220V	0.05	Basic gain (Ref DAC to input ratio)
OF_220V	0.0	Full scale calibrated DC offset

Group ZC_220V: More DC Constants, 220V Range

NAME	DEFAULT	FUNCTION
Z_220V	0.0	Zero calibrated DC offset
IA_220V	100.0	Rough gain (input to A/D ratio)

Group AC_220V: Flatness Constants, 220V Range

NAME	DEFAULT	FUNCTION
F1_220V	1.0	(10 Hz)
F2_220V	1.0	(1 kHz)
F3_220V	1.0	(20 kHz)
F4_220V	1.0	(100 kHz)

Group DC_700V: DC Constants, 700V Range

NAME	DEFAULT	FUNCTION
DI_700V	0.01	Basic gain (Ref DAC to input ratio)
OF_700V	0.0	Full scale calibrated DC offset

Group ZC_700V: More DC Constants, 700V Range

NAME	DEFAULT	FUNCTION
Z_700V	0.0	Zero calibrated DC offset
IA_700V	316.228	Rough gain (input to A/D ratio)

Group AC_700V: Flatness Constants, 700V Range

NAME	DEFAULT	FUNCTION
F1_700V	1.0	(10 Hz)
F2_700V	1.0	(1 kHz)
F3_700V	1.0	(20 kHz)
F4_700V	1.0	(100 kHz)

Group DC_1000V: DC Constants, 1000V Range

NAME	DEFAULT	FUNCTION
DI_1000V	0.005	Basic gain (Ref DAC to input ratio)
OF_1000V	0.0	Full scale calibrated DC offset

Group ZC_1000V: More DC Constants, 1000V Range

NAME	DEFAULT	FUNCTION
Z_1000V	0.0	Zero calibrated DC offset
IA_1000V	1000.0	Rough gain (input to A/D ratio)

Group AC_1000V: Flatness Constants, 1000V Range

NAME	DEFAULT	FUNCTION
F1_1000V	1.0	(10 Hz)
F2_1000V	1.0	(1 kHz)
F3_1000V	1.0	(20 kHz)
F4_1000V	1.0	(100 kHz)

Group WDC_2_2MV: Gain Constants, Wideband 2.2 mV Range

NAME	DEFAULT	FUNCTION
DI_2_2MV_WB	5000.0	Basic gain (Ref DAC to input ratio)
IA_2_2MV_WB	0.0316228	Rough gain (input to A/D ratio)

Group WAC_2_2MV: Flatness Constants, Wideband 2.2 mV Range

NAME	DEFAULT	FUNCTION
F1_2_2MV_WB	1.0	(10 Hz)
F2_2_2MV_WB	1.0	(100 Hz)
F3_2_2MV_WB	1.0	(1 kHz)
F4_2_2MV_WB	1.0	(10 kHz)
F5_2_2MV_WB	1.0	(50 kHz)
F6_2_2MV_WB	1.0	(200 kHz)
F7_2_2MV_WB	1.0	(500 kHz)
F8_2_2MV_WB	1.0	(1 MHz)
F9_2_2MV_WB	1.0	(2 MHz)
F10_2_2MV_W	B 1.0	(4 MHz)
F11_2_2MV_W	B 1.0	(8 MHz)

Group WAC_2_2MV: Flatness Constants, Wideband 2.2 mV Range (cont)

NAME	DEFAULT	FUNCTION
F12_2_2MV_W	B 1.0	(10 MHz)
F13_2_2MV_W	B 1.0	(15 MHz)
F14_2_2MV_W	B 1.0	(20 MHz)
F15_2_2MV_W	B 1.0	(26 MHz)
F16_2_2MV_W	B 1.0	(30 MHz)

Group WDC_7MV: Gain Constants, Wideband 7 mV Range

NAME	DEFAULT	FUNCTION
DI_7MV_WB	1000.0	Basic gain (Ref DAC to input ratio)
IA_7MV_WB	0.1	Rough gain (input to A/D ratio)

Group WAC_7MV: Flatness Constants, Wideband 7 mV Range

NAME	DEFAULT	FUNCTION
F1_7MV_WB	1.0	(10 Hz)
F2_7MV_WB	1.0	(100 Hz)
F3_7MV_WB	1.0	(1 kHz)
F4_7MV_WB	1.0	(10 kHz)
F5_7MV_WB	1.0	(50 kHz)
F6_7MV_WB	1.0	(200 kHz)
F7_7MV_WB	1.0	(500 kHz)
F8_7MV_WB	1.0	(1 MHz)
F9_7MV_WB	1.0	(2 MHz)
F10_7MV_WB	1.0	(4 MHz)
F11_7MV_WB	1.0	(8 MHz)
F12_7MV_WB	1.0	(10 MHz)
F13_7MV_WB	1.0	(15 MHz)
F14_7MV_WB	1.0	(20 MHz)
F15_7MV_WB	1.0	(26 MHz)
F16_7MV_WB	1.0	(30 MHz)

Group WDC_22MV: Gain Constants, Wideband 22 mV Range

NAME	DEFAULT	FUNCTION
DI_22MV_WB	500.0	Basic gain (Ref DAC to input ratio)

Group WDC_22MV: Gain Constants, Wideband 22 mV Range (cont)

NAME	DEFAULT	FUNCTION
IA_22MV_WB	0.316228	Rough gain (input to A/D ratio)

Group WAC_22MV: Flatness Constants, Wideband 22 mV Range

NAME	DEFAULT	FUNCTION
F1_22MV_WB	1.0	(10 Hz)
F2_22MV_WB	1.0	(100 Hz)
F3_22MV_WB	1.0	(1 kHz)
F4_22MV_WB	1.0	(10 kHz)
F5_22MV_WB	1.0	(50 kHz)
F6_22MV_WB	1.0	(200 kHz)
F7_22MV_WB	1.0	(500 kHz)
F8_22MV_WB	1.0	(1 MHz)
F9_22MV_WB	1.0	(2 MHz)
F10_22MV_WB	1.0	(4 MHz)
F11_22MV_WB	1.0	(8 MHz)
F12_22MV_WB	1.0	(10 MHz)
F13_22MV_WB	1.0	(15 MHz)
F14_22MV_WB	1.0	(20 MHz)
F15_22MV_WB	1.0	(26 MHz)
F16_22MV_WB	1.0	(30 MHz)

Group WDC_70MV: Gain Constants, Wideband 70 mV Range

NAME	DEFAULT	FUNCTION
DI_70MV_WB	100.0	Basic gain (Ref DAC to input ratio)
IA_70MV_WB	1.0	Rough gain (input to A/D ratio)

Group WAC_70MV: Flatness Constants, Wideband 70 mV Range

NAME	DEFAULT	FUNCTION
F1_70MV_WB	1.0	(10 Hz)
F2_70MV_WB	1.0	(100 Hz)
F3_70MV_WB	1.0	(1 kHz)
F4_70MV_WB	1.0	(10 kHz)
F5_70MV_WB	1.0	(50 kHz)

Group WAC_70MV: Flatness Constants, Wideband 70 mV Range (cont)

NAME	DEFAULT	FUNCTION
F6_70MV_WB	1.0	(200 kHz)
F7_70MV_WB	1.0	(500 kHz)
F8_70MV_WB	1.0	(1 MHz)
F9_70MV_WB	1.0	(2 MHz)
F10_70MV_WB	1.0	(4 MHz)
F11_70MV_WB	1.0	(8 MHz)
F12_70MV_WB	1.0	(10 MHz)
F13_70MV_WB	1.0	(15 MHz)
F14_70MV_WB	1.0	(20 MHz)
F15_70MV_WB	1.0	(26 MHz)
F16_70MV_WB	1.0	(30 MHz)

Group WDC_220MV: Gain Constants, Wideband 220 mV Range

NAME	DEFAULT	FUNCTION
DI_220MV_WB	31.6228	Basic gain (Ref DAC to input ratio)
IA_220MV_WB	3.16228	Rough gain (input to A/D ratio)

Group WAC_220MV: Flatness Constants, Wideband 220 mV Range

NAME	DEFAULT	FUNCTION
F1_220MV_WB	1.0	(10 Hz)
F2_220MV_WB	1.0	(100 Hz)
F3_220MV_WB	1.0	(1 kHz)
F4_220MV_WB	1.0	(10 kHz)
F5_220MV_WB	1.0	(50 kHz)
F6_220MV_WB	1.0	(200 kHz)
F7_220MV_WB	1.0	(500 kHz)
F8_220MV_WB	1.0	(1 MHz)
F9_220MV_WB	1.0	(2 MHz)
F10_220MV_W	B 1.0	(4 MHz)
F11_220MV_W	B 1.0	(8 MHz)
F12_220MV_W	B 1.0	(10 MHz)
F13_220MV_W	B 1.0	(15 MHz)
F14_220MV_W	B 1.0	(20 MHz)

Group WAC_220MV: Flatness Constants, Wideband 220 mV Range (cont)

NAME	DEFAULT	FUNCTION
F15_220MV_W	B 1.0	(26 MHz)
F16_220MV_W	B 1.0	(30 MHz)

Group WDC_700MV: Gain Constants, Wideband 700 mV Range

NAME	DEFAULT	FUNCTION
DI_700MV_WB	10.0	Basic gain (Ref DAC to input ratio)
IA_700MV_WB	10.0	Rough gain (input to A/D ratio)

Group WAC_700MV: Flatness Constants, Wideband 700 mV Range

NAME	DEFAULT	FUNCTION
F1_700MV_WB	1.0	(10 Hz)
F2_700MV_WB	1.0	(100 Hz)
F3_700MV_WB	1.0	(1 kHz)
F4_700MV_WB	1.0	(10 kHz)
F5_700MV_WB	1.0	(50 kHz)
F6_700MV_WB	1.0	(200 kHz)
F7_700MV_WB	1.0	(500 kHz)
F8_700MV_WB	1.0	(1 MHz)
F9_700MV_WB	1.0	(2 MHz)
F10_700MV_W	B 1.0	(4 MHz)
F11_700MV_W	B 1.0	(8 MHz)
F12_700MV_W	B 1.0	(10 MHz)
F13_700MV_W	B 1.0	(15 MHz)
F14_700MV_W	B 1.0	(20 MHz)
F15_700MV_W	B 1.0	(26 MHz)
F16_700MV_W	B 1.0	(30 MHz)

Group WDC_2_2V: Gain Constants, Wideband 2.2V Range

NAME	DEFAULT	FUNCTION
DI_2_2V_WB	3.16228	Basic gain (Ref DAC to input ratio)
IA_2_2V_WB	31.6228	Rough gain (input to A/D ratio)

Group WAC_2_2V: Flatness Constants, Wideband 2.2V Range

NAME	DEFAULT	FUNCTION
F1_2_2V_WB	1.0	(10 Hz)
F2_2_2V_WB	1.0	(100 Hz)
F3_2_2V_WB	1.0	(1 kHz)
F4_2_2V_WB	1.0	(10 kHz)
F5_2_2V_WB	1.0	(50 kHz)
F6_2_2V_WB	1.0	(200 kHz)
F7_2_2V_WB	1.0	(500 kHz)
F8_2_2V_WB	1.0	(1 MHz)
F9_2_2V_WB	1.0	(2 MHz)
F10_2_2V_WB	1.0	(4 MHz)
F11_2_2V_WB	1.0	(8 MHz)
F12_2_2V_WB	1.0	(10 MHz)
F13_2_2V_WB	1.0	(15 MHz)
F14_2_2V_WB	1.0	(20 MHz)
F15_2_2V_WB	1.0	(26 MHz)
F16_2_2V_WB	1.0	(30 MHz)

Group WDC_7V: Gain Constants, Wideband 7V Range

NAME	DEFAULT	FUNCTION
DI_7V_WB	1.0	Basic gain (Ref DAC to input ratio)
IA_7V_WB	100.0	Rough gain (input to A/D ratio)

Group WAC_7V: Flatness Constants, Wideband 7V Range

NAME	DEFAULT	FUNCTION
F1_7V_WB	1.0	(10 Hz)
F2_7V_WB	1.0	(100 Hz)
F3_7V_WB	1.0	(1 kHz)
F4_7V_WB	1.0	(10 kHz)
F5_7V_WB	1.0	(50 kHz)
F6_7V_WB	1.0	(200 kHz)
F7_7V_WB	1.0	(500 kHz)
F8_7V_WB	1.0	(1 MHz)
F9_7V_WB	1.0	(2 MHz)

Group WAC_7V: Flatness Constants, Wideband 7V Range (cont)

NAME	DEFAULT	FUNCTION
F10_7V_WB	1.0	(4 MHz)
F11_7V_WB	1.0	(8 MHz)
F12_7V_WB	1.0	(10 MHz)
F13_7V_WB	1.0	(15 MHz)
F14_7V_WB	1.0	(20 MHz)
F15_7V_WB	1.0	(26 MHz)
F16_7V_WB	1.0	(30 MHz)

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